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ABSTRACT

This study guide is intended as preparation for a visit to a pond. Each lesson includes pre-study questions and post-study questions involving the content of the lesson. Numerous drawings and diagrams are included in each lesson. Also included in the guide are a glossary, bibliography, and a detailed teacher's guide. (RE)

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THE POND COMMUNITY

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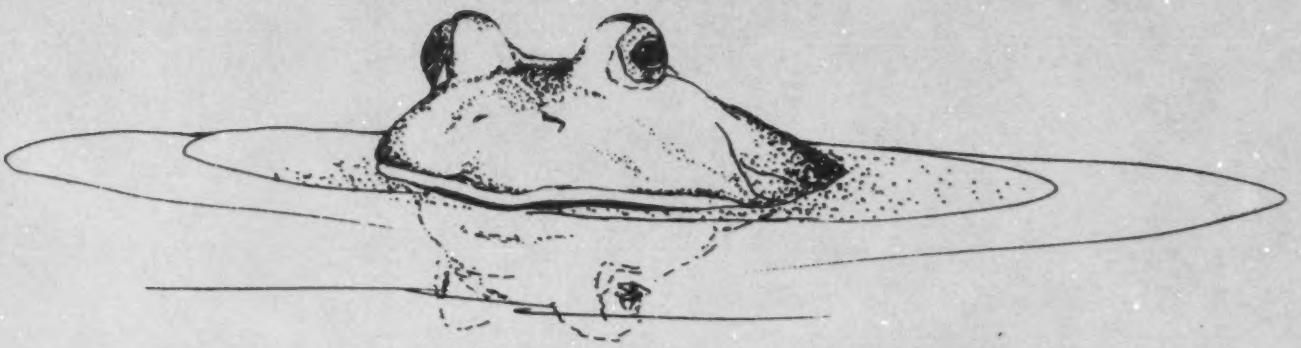


TO THE STUDENT

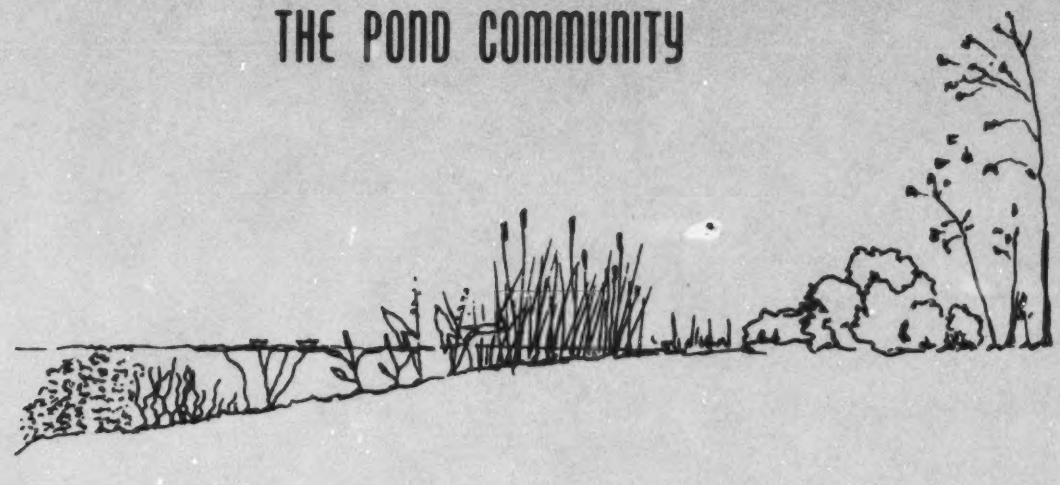
The study of The Pond Community can be one of the most exciting ecological experiences you can undertake. The pond is a little world in which numerous plants and animals live together and provide for each other's needs. A visit to a pond is much more meaningful if you have some knowledge of the types of animals and plants that live there. It is even more interesting if you know how these plants and animals are adapted to live in such a community.

As you study this book, you will find "Precroakers" and "Postcroakers." These are questions at the beginning and end of each part of this text. The "Precroakers" help you identify important ideas you should look for as you read. The "Postcroakers" serve as summary questions and often contain items that require additional investigation in other sources.

This text is supported by a magnetic board that your teacher will use as you discuss The Pond Community. Use the magnetic board to solve the problems presented, and think of new ways to use this board to help others.

This study would not be complete without a visit to a local pond. If visiting a pond is something you plan to do, please remember to use the "buddy system." Do not go alone!

THE POND COMMUNITY



When ecologists study a certain place, they study the non-living parts of that place and the plants and animals that live there. It is the living things that form a community. Some types of communities are forest, desert, meadow, lake, stream and pond. A community can be small, such as a decaying log, or very large as is the case of the desert.

We are about to study a pond community. This community is larger than just the water and the plants and animals that live in it. It also includes the plants and animals that live nearby for it is unlikely that certain plants and animals would be found in an area if the pond did not exist.

A population of animals or plants cannot live by itself. All living things depend on other living things to survive. For this reason, they live in communities which are made up of populations of several kinds of animals and plants living together.

Perhaps there is no ecological community where as many different types of plants and animals live as a well-developed pond. To a good pond observer, a splash can mean that a frog, a turtle, a muskrat, a fish, or a bird is nearby. On the surface of a pond, one can find whirligig beetles swimming in a disorderly manner, and water striders gingerly skipping from place to place. Beneath the surface, water boatman, diving beetles, backswimmers, dragonfly and damselfly nymphs, water scorpions, mayfly nymphs, crayfish, tadpoles and fish can be found.

Willows and cattails grow in large numbers along the shoreline. Water lilies, duckweed, pickerelweed, eelgrass and elodea may be growing on the surface or below the surface of the water. Birds and mammals are also abundant in a pond area. Red-winged blackbirds, kingfishers, herons, hawks, owls, ducks, and numerous song birds are common and muskrats, raccons and mice can be found living or feeding along the shoreline.

CHARACTERISTICS OF A POND

Precroakers

1. How would you compare a pond to a lake?
2. Why are plants necessary in a pond?
3. What do we mean by pond zones?
4. How does temperature affect a pond?

Ponds are bodies of water that are smaller than lakes, and rather shallow. They are found in marshy meadows, at the edges of woods, forest floors, or are man-made. Water that fills the ponds may be supplied by a spring, a stream, drainage from hillsides, or a combination of these sources. On occasion, ponds are formed by beavers building dams across small streams. This is particularly true in Lake and Ashtabula Counties of Ohio where the beaver population is on the increase.

The Need for Oxygen

Oxygen dissolves in water in much the same way as salt dissolves in water. Such dissolved oxygen is necessary to all living things found in a pond. It is needed for proper use of food and energy by animals, and for the production of living matter by both animals and plants.

The oxygen in a pond is produced by green plants during the process of photosynthesis. This process uses the sun's energy, carbon dioxide, and water to produce sugar, releasing the oxygen which the animals need. Oxygen can also

be dissolved by the wind disturbing the water's surface and allowing the water to "capture" the oxygen from the air. Pollution and large quantities of dead water plants will reduce the amount of dissolved oxygen since oxygen is used in the decaying process.

The Effect of Temperature

Most organisms that live in water have body temperatures that are the same as their surroundings. Animals such as frogs, fish and insects whose body temperature is the same as the temperature of the environment are said to be cold-blooded.

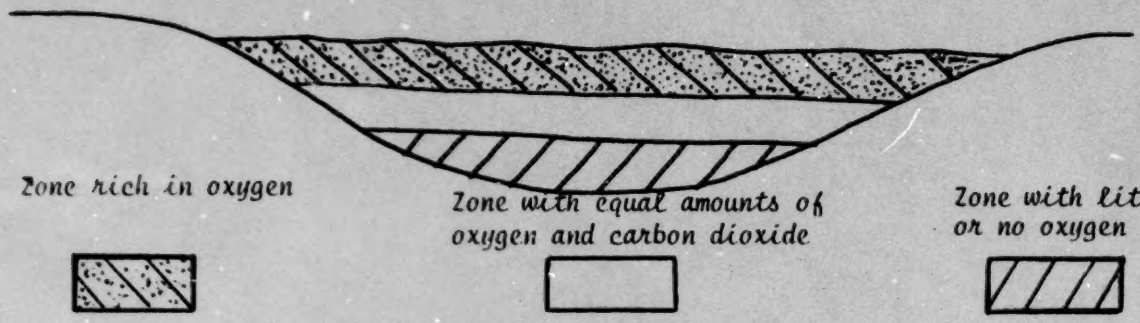
The water temperature also affects the amount of oxygen that can be dissolved. This is similar to the ability of cold soda-pop to hold its trapped gases better than warm soda-pop. By experience, you know that opening a container of warm pop causes uncontrollable fizzing. This fizzing occurs when the carbon dioxide escapes rapidly from the liquid. This is less likely to happen with cold soda-pop.

The Importance of Plants

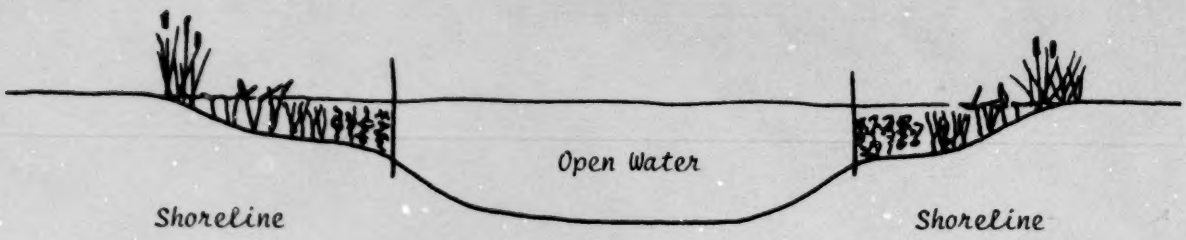
In addition to the effects of temperature and light, the quantity of living and dead organisms in a pond influences the amount of available oxygen. Since dead organisms fall to the bottom of the pond, it is there that the major decomposition of plants and animals occurs. This decomposition process uses oxygen and gives off carbon dioxide. The bottom layer of the pond also forms bad-smelling gases caused by this decomposition of matter.

In the upper pond layers where sunlight penetrates, photosynthesis occurs, producing oxygen. Since water is not always clear, the amount of murkiness can cause less oxygen-production at greater depths where penetration of sunlight is reduced.

Between the zone where little or no oxygen occurs and the zone where oxygen is produced in quantity, a third zone exists where oxygen and carbon dioxide are produced in balanced amounts.



The pond is further subdivided into areas of open water and shoreline. The shoreline area is that region where rooted plants grow and sunlight penetrates to the bottom. Though the shoreline is more interesting to study, the open water is more important in terms of oxygen production. It is here that phytoplankton (tiny microscopic plants which are the pond's greatest oxygen producers), is found in great abundance.



Postcroakers

1. How does the decaying process affect a pond?
2. Where is most of the pond oxygen produced and what produces it?
3. Would more oxygen be produced in a clear pond than in a murky pond? Why

ON THE SURFACE

Precroakers

1. What are two insects that live on the pond's surface?
2. Which one of these insects swims in a disorderly way?
3. How does a fisher spider breathe when under water?
4. What does a fisher spider eat?

No two ponds are alike. Animals and plants normally found in one pond may not be found in another. What you observe when you study a pond depends greatly on your own skill at finding things. Frogs, fish, and birds will quickly flee if you are noisy when observing.

Water Striders

Perhaps you are familiar with some of the animals that live on the surface of ponds. A water strider is one of the familiar water insects. It skates and jumps about on the surface of the water without fear of sinking. Its six hairy feet are covered with a waxy coating which repels water and keeps the insect afloat. The first pair of legs aids in feeding while the second and third pairs of legs are used to move from place to place. Other common names for the water strider are "pond skater" and "wherryman".

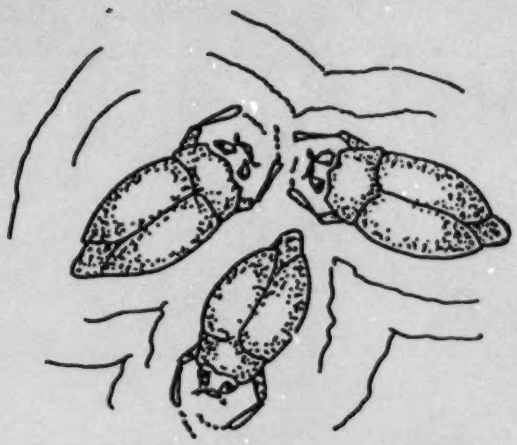
Water Strider

Whirligig Beetle

The whirligig beetle is another surface dwelling insect. It glides around like a little speedboat and gives the impression that it is happy and that life is one big holiday! Some people say they behave like "drunken drivers" in that

they whirl about the surface of the pond in a disorganized manner.

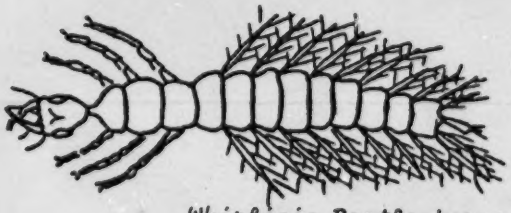
An unusual feature of this beetle is that it has divided eyes. Half of each eye looks under water while the rest looks above. It watches both worlds at once as it glides about in search of insects that fall on or into the water.



Whirligig Beetles

The whirligig beetle has a divided eye that helps it see above and below the water's surface.

The whirligig beetle that you observe on the surface is an adult. The larva of this insect lives and feeds beneath the surface of the water.



Whirligig Beetle Larva

Water Spiders

The fisher spider is sometimes seen in places where there is a dense growth of aquatic plants. It walks across plants and water with equal ease. When frightened, it may crawl down a stem below the water's surface. This spider is covered with fine body hairs which trap a thin jacket of air that supplies

enough oxygen for the spider's use while submerged. It is possible for this spider to remain under water for one-half an hour without surfacing. The fisher spider is not an insect. Do you know why?

The fisher spider can carry its own air supply.

Fisher Spider

Postcroakers

1. Why doesn't a water strider sink?
2. What is the advantage of the whirligig beetle's divided eye?
3. Does the whirligig beetle dive below the surface? If so, how does it get oxygen?
4. What does the whirligig beetle eat?
5. How does the fisher spider get air when it dives below the surface?

ON THE BOTTOM

Precroakers

1. What animals can live on the bottom of ponds at depths too deep for plants to grow?
2. What kind of food can animals find at the bottom of a pond?
3. What is a flatworm and where does it live?
4. What cleaning service is done by snails?

It seems unlikely that the bottom of a pond is a place where animals live. Yet there are a number of organisms that live on, or in the pond bottom at depths too deep for plants to grow. There is a surprisingly ample supply of food available. When plants and animals die, they usually fall to the bottom where bacteria and fungi break down the dead matter.

Although the food supply is plentiful, the dissolved oxygen content of the water is low. This is because, in the process of breaking down the dead matter, oxygen is used and carbon dioxide is given off. This lack of oxygen limits the number of different types of animals that can make their homes at the bottom of ponds.

Stentor

If you have a microscope available, you may wish to collect and view samples of pond water taken at the bottom. You will probably find a number of one-celled animals (protozoa) present. Some will be paramecium, amoeba, and stentors.

Paramecium

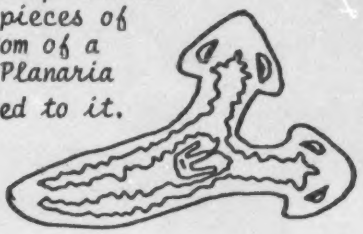
Planaria

An interesting animal found at the bottom of a pond is the planaria. Because they avoid sunlight, they are often found under rocks, feeding on dead animal matter. The planaria is a flatworm which, when cut into pieces, will grow a head and a tail from each piece! These pieces grow into an adult animal.

Adult Planaria

Planaria can be found under rocks in streams and ponds.

Try to collect planaria by putting small pieces of liver on the bottom of a pond or stream. Planaria should be attracted to it.



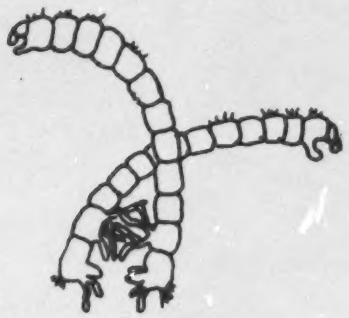
By splitting the planaria in this way you can get it to develop two heads.

When a planaria is cut into pieces, each piece will grow into an adult.

You can produce a two-headed planaria when you cut the animal as shown in this drawing. It is little wonder why this flatworm has become such an interesting specimen for study by biology students.

Bloodworm

Another common bottom-dweller is the bloodworm. Its blood works in much the same way as ours. The red material aids the organism in breathing even when very little oxygen is present. Although it is worm-like in shape, it is not a worm; it is the larva of an insect. The adult form looks a little like a mosquito and is called a midge. This worm-like animal is an excellent source of food for both large and small fish.

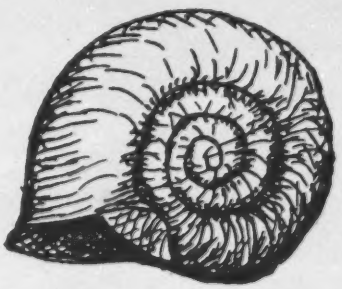


Bloodworms

Midge

Snails

All of us are familiar with the snails we keep in our aquariums. We know that our aquarium snails eat such things as dead plants and algae. In a pond, snails provide this same type of cleaning service. They eat the dead plants and algae in a pond community.



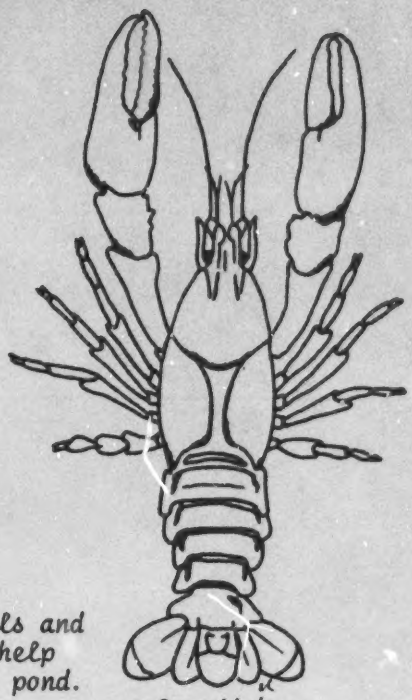
Snail

Crayfish

Another animal that provides a cleaning service in the pond community is the crayfish. This animal is a scavenger in that it eats animal life that dies and falls to the pond bottom. In addition to being a scavenger, the crayfish is also a predator, and will feed on most small animals it can capture.

The crayfish is of particular interest because it has an exoskeleton (a skeleton on the outside of its body) which it must shed as it grows. When the

crayfish sheds its outer skeleton, the new skeleton is very soft. This process of shedding is called molting. A newly molted crayfish has a very soft shell. Perhaps you have heard fishermen praise the merits of soft-shelled crayfish as bait. Why would a soft-shelled crayfish be better bait for fishing than a crayfish that is not newly molted?



Snails and crayfish help clean the pond.

Crayfish

Postcroakers

1. What is an exoskeleton?
2. What animals beside the crayfish have an exoskeleton?
3. How does a snail move from place to place?
4. Which of the bottom-dwellers are scavengers?
5. What bottom scavenger is also a predator?

LITTORAL ZONE ANIMALS

Precroakers

1. What is the littoral zone of a pond?
2. What are the stages of complete metamorphosis?
3. What is an example of an insect that undergoes complete metamorphosis?
4. What is a nymph? Give an example.

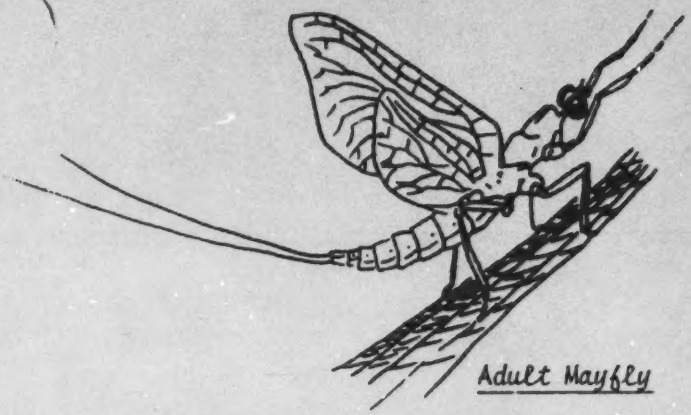
The edge of the pond (littoral zone) is the region where rooted plants grow and light penetrates to the bottom permitting vegetative growth. It is in this area where a number of pond creatures spend most of their aquatic life. A few of these edge-dwellers should be discussed at this time.

Mayfly

Some insects such as the housefly and the butterfly, undergo complete metamorphosis. That is to say that they develop through the following stages: egg, larva, pupa, and adult. Other insects, such as the dragonflies, damselflies, and mayflies undergo incomplete metamorphosis. The life history of such insects is egg, nymph, and adult. Sometimes the nymph looks very much like the adult as in the grasshopper and crickets. However, the nymphs of mayflies, dragonflies, and damselflies show very little resemblance to the adults.

As an nymph, the mayfly eats algae and other aquatic plants. The adult, on the other hand, does not eat during its brief period of life. It lives only long enough to mate and lay eggs.

Mayfly Nymph

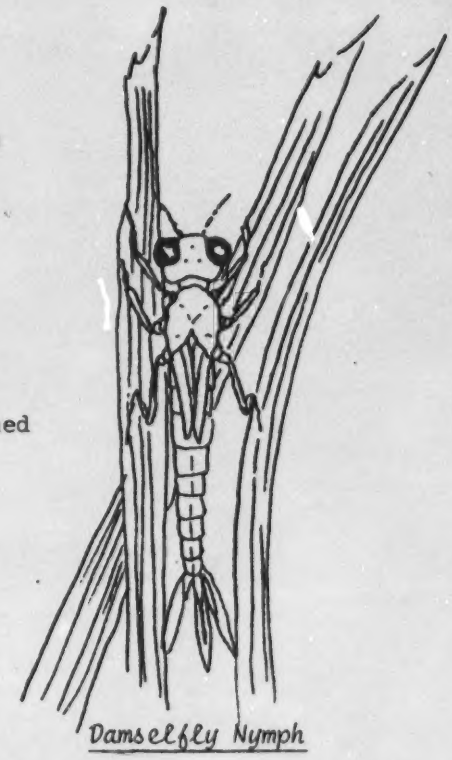


Adult Mayfly

Dragonfly and Damselfly

In the spring, summer and fall, you are almost certain to see adult dragonflies darting along in pursuit of insects. The nymphs of these graceful insects live in the littoral zone of ponds. They are predators both during their adult life on land and their life in the water. A dragonfly nymph can even capture small minnows in its unusual jaw structure.

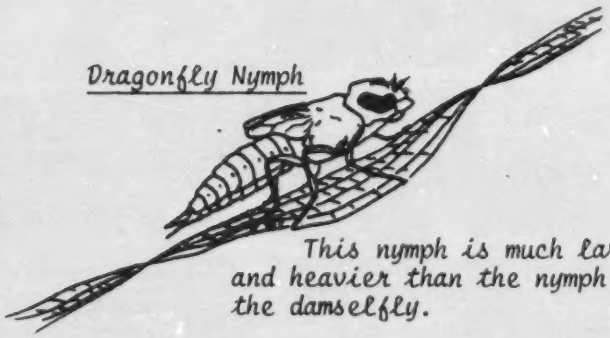
When a nymph is ready to shed its outer skin and emerge as a dragonfly or a damselfly, it crawls up a twig of a plant stem until it is well above the water level. The skin is then shed and the adult insect emerges.



Damselfly Nymph

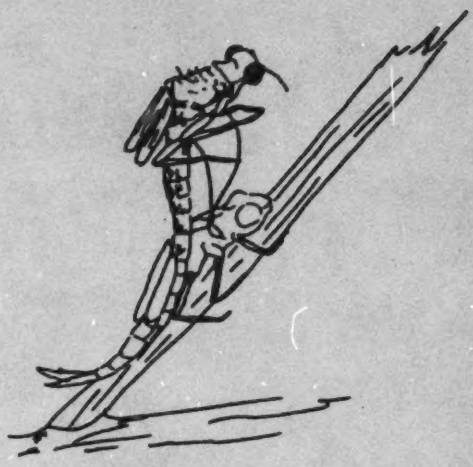
Notice the three pronged tail.

Dragonfly Nymph



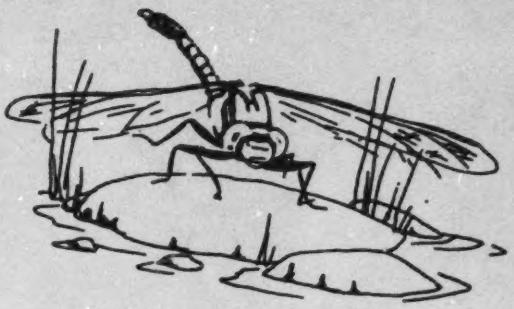
This nymph is much larger and heavier than the nymph of the damselfly.

It is easy to distinguish between an adult dragonfly and an adult damselfly. When the dragonfly perches on a stem, its wings are spread out as shown; but when a damselfly perches, its wings are held in a vertical position. These insects are capable of catching other insects while both are in flight. They simply fly over them and grasp the insect's body with their strong legs.



Damselfly Nymph Shedding Skin

Damselfly at Rest



Dragonfly at Rest

Postcroakers

1. What are the stages of incomplete metamorphosis?
2. What insects undergo incomplete metamorphosis?
3. How can you tell a dragonfly from a damselfly?
4. What does a dragonfly nymph eat? How does it catch its food?
5. How do adult dragonflies catch their food?

TINY DRIFTING AND SWIMMING PLANTS AND ANIMALS

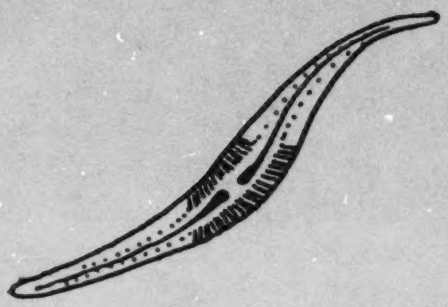
Precroakers

1. What are phytoplankton?
2. What are zooplankton?
3. Why is plankton important to a pond?
4. How can you collect plankton?
5. What are the three main groups of zooplankton?
6. How can you make a plankton net?

When you walk in a forest, you cannot help noticing the large trees and most wildflowers, but you may not be so quick to find such plants as moss or mushrooms. In a pond community, there are plants such as cattails that are large and easily observed. There are also plants which are so tiny that you must use a microscope to see them.

These microscopic plants are called phytoplankton. Just as grass is an important food source for cattle, phytoplankton serves as food for bloodworms and other small animals. In addition, they are the primary producers of dissolved oxygen in pond water.

One of the simplest of the phytoplankton is the diatom. They are single-celled plants that can often be found in great numbers drifting about in the open pond water. Sometimes the numbers become so great that they change the color of the water.

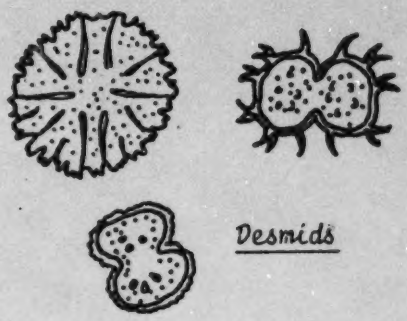


Diatoms

You would need to use a microscope to observe these tiny free floating plants.

Another form of phytoplankton is the desmid. The desmid is actually a variety of green algae.

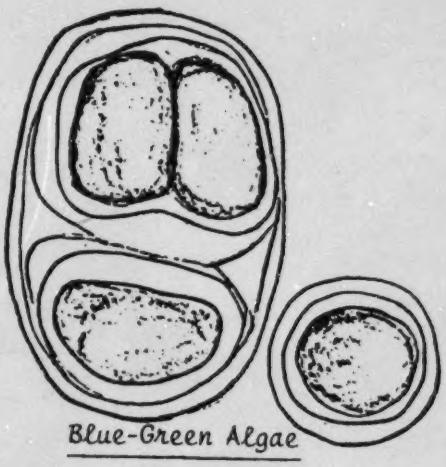
The type of phytoplankton in a pond is a good indication of the degree of pollution. A large quantity of nitrates and phosphates stimulate the growth of blue-green algae. This blue-green algae, a type of phytoplankton, will reproduce rapidly and may give the pond the appearance of "pea soup." These plants die and fall to the bottom where the decay process takes place. This decay process uses oxygen to help bacteria break down the dead algae. The result is that animals living in the water may die for lack of oxygen.



Desmids

There are many different types of desmids and blue-green algae.

Blue-Green Algae

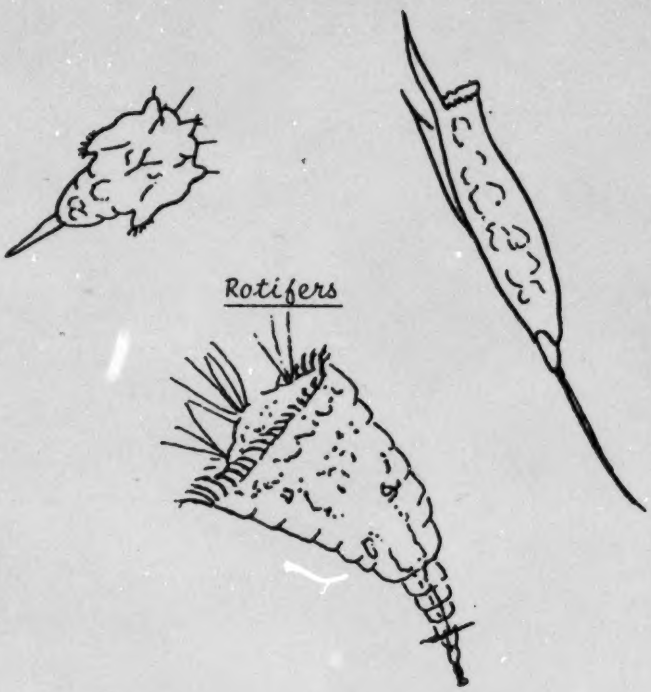


Blue-Green Algae

Zooplankton - The Tiny Swimming and Drifting Animals

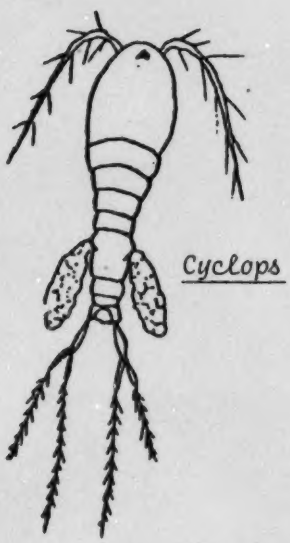
There are three main groups of zooplankton: protozoa, rotifers, and crustaceans. We have previously mentioned protozoa, as bottom dwellers, but we have not mentioned the rotifers and crustaceans.

Rotifers are tiny animals containing more than one cell. They occur in most freshwater, streams, lakes, ponds, and even puddles! They appear to have a pair of rotating wheels that direct the food into their mouths. These "wheels" are actually hairlike structures called cilia.

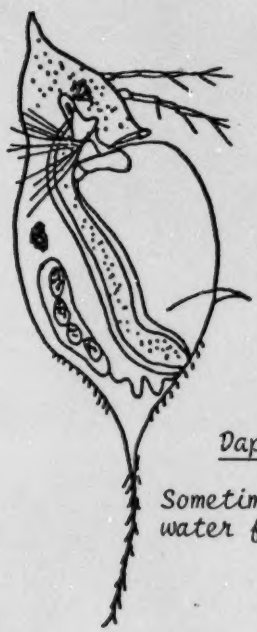


Rotifers

Two very important zooplankton, Daphnia and Cyclops, belong to the group we call crustaceans. These small animals, usually found in great numbers, feed on the smaller plankton. They are an important source of food for small fish and insects.



Cyclops



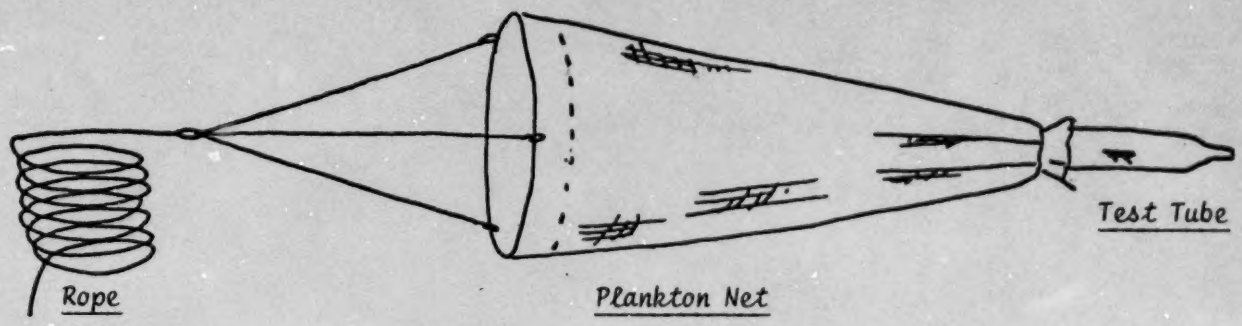
Daphnia

Sometimes called a water flea.

Cyclops and Daphnia feed on smaller plankton in the water.

Collecting Phytoplankton and Zooplankton

When your class takes a trip to a pond, you will want to capture some plankton to take back to your classroom for observation. You will need a plankton net and a length of rope. In the event a plankton net is not available, a clever student can make one using wire, a test tube, and lady's hose. The illustration of this net can be used as a model.



Plankton nets are very expensive since the mesh must be durable, yet fine enough to trap the microscopic animals and plants. Care must be taken not to damage the equipment by catching the net on submerged branches and other objects.

When using the plankton net, toss it into the water and slowly pull it to shore. BE SURE TO HOLD ONTO THE ROPE WHEN YOU MAKE THE TOSS! The plankton will collect in the test tube. Empty the test tube into a container that can be taken back to the classroom for study. You will want to collect several samples to insure an adequate supply and variety of plankton.

While in the classroom, observe the plankton by using a microprojector or a microscope. Do your observations on the same day you do your collecting. Since you have a heavy concentration of plankton in your collecting vial, they may die after a few hours. This makes it necessary to do your observation as soon as possible.

Postcroakers

1. How do plankton move from place to place?
2. What do they eat?
3. How are algae helpful to a pond?
4. How are algae harmful to a pond?
5. How are Daphnia and Cyclops similar?
6. What happens if the phosphates and nitrates are too plentiful in a pond?

AQUATIC INSECTS THAT BREATHE AIR

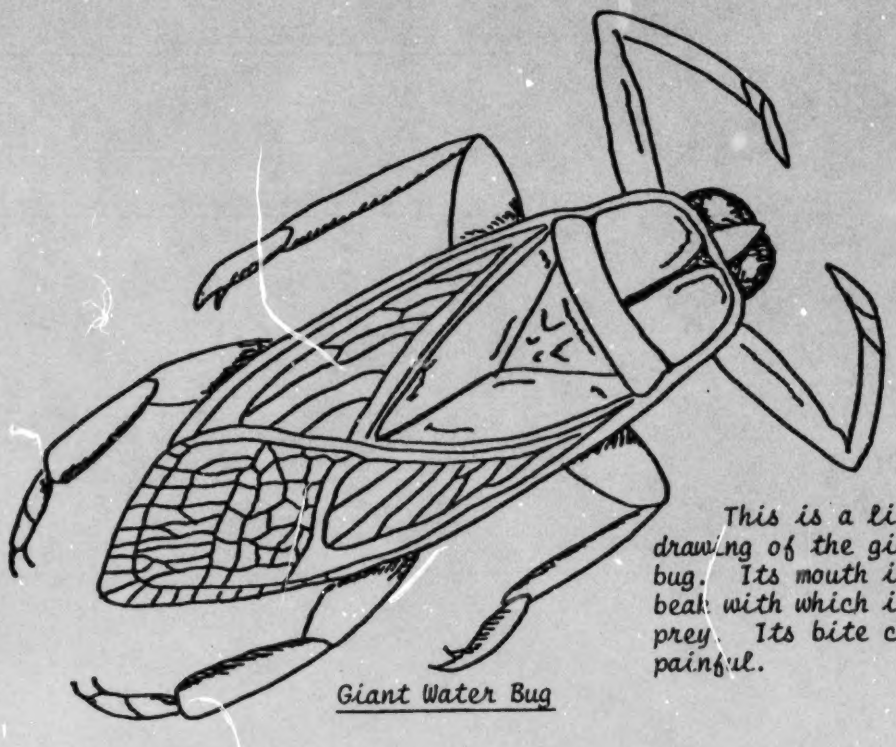
Precroakers

1. What is the largest air-breathing aquatic insect?
2. What are several aquatic insects that live under water but must surface to breathe?
3. Will aquatic insects bite people?
4. What aquatic insect swims upside-down?

The Giant Water Bug

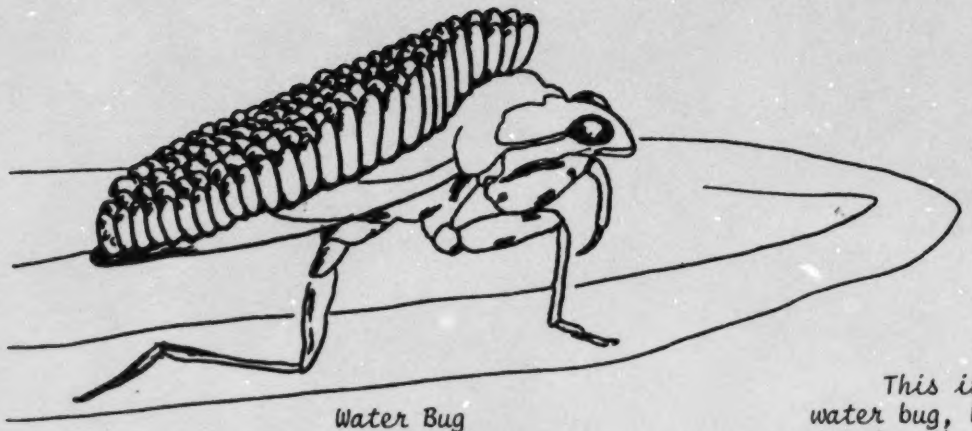
You would not expect to find the larger aquatic insects of a pond as plentiful as the smaller insects. If you should be lucky enough to find a giant water bug, it may frighten you! This insect grows to be three inches long and feeds on such aquatic animals as minnows, tadpoles, dragonfly nymphs and damsel-fly nymphs.

The giant water bug is the largest of our air-breathing aquatic insects found in the Cleveland, Ohio area. There is, however, a more common species of water bug that grows to approximately an inch in length. The female lays her eggs on the back of the male. It is his responsibility to protect the eggs until they hatch.



Giant Water Bug

This is a life size drawing of the giant water bug. Its mouth is a type of beak with which it kills its prey. Its bite can be very painful.

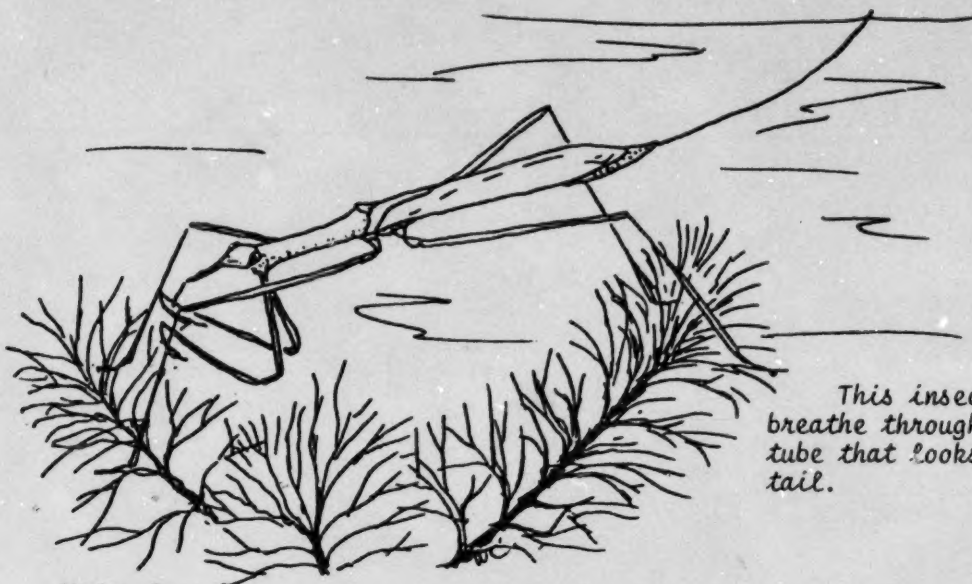


Water Bug

This is another giant water bug, but it is smaller in size than the one above. How can you tell if this insect is male or female?

The Water Scorpion

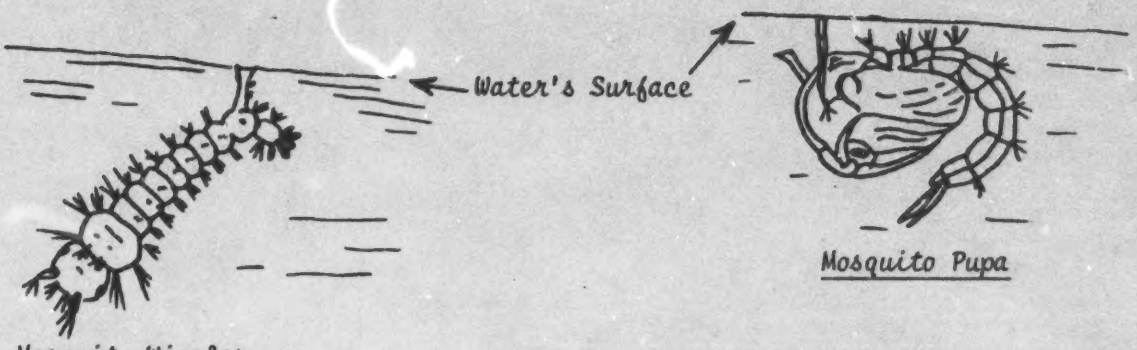
All the insects we are discussing must come to the surface of the water for air. Unlike many pond insects, they cannot take oxygen from the water. Some insects breathe in very interesting ways. The water scorpion breathes through straw-like tubes extending from the tip of its abdomen. This means that it hands upside-down with the tip of this tube out of water. Although it is called the water scorpion, it is not a poisonous insect.



Water Scorpion

Mosquito

Another insect that must come to the surface for air is the larva of the mosquito, called the wiggler. As you probably know, the life history of the mosquito includes the egg, larva, pupa, and adult. When an insect goes through these four stages of development, we say it undergoes complete metamorphosis. The larva and pupa stages of the moquito are spent underwater but both must surface to breathe. Both hang upside-down near the surface with breathing tubes extending above the water, in much the same way as the water scorpion.

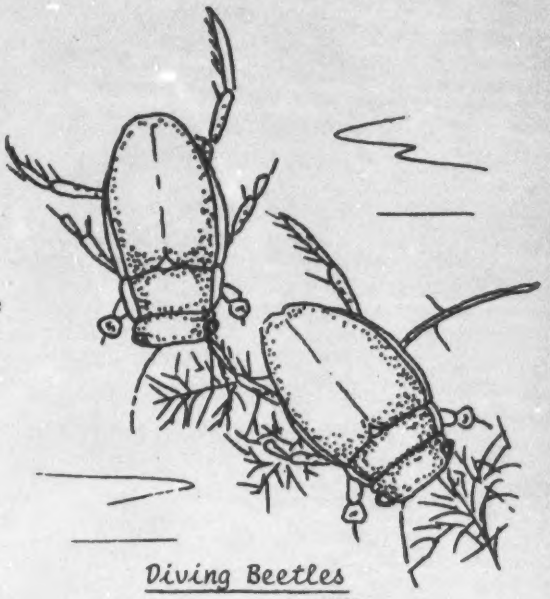


Mosquito Wiggler

Mosquito Pupa

Predaceous Diving Beetle

The predaceous diving beetle is an extremely fierce killer. The larva is even more fierce than the adult. Both are well-equipped to do battle because their jaws are very strong. Diving beetles, as well as whirligig beetles mentioned earlier, carry an air bubble down into the water with them. This air bubble attaches to the tip of the abdomen and provides air for the insect when it is submerged. If you capture several diving or whirligig beetles, place them in an aquarium and look for the air bubbles.



Diving Beetles

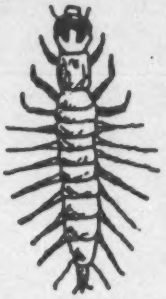
The adult diving beetle and the diving beetle larva are fierce fighters.

Diving Beetle Attacking a Bloodworm

Water Boatman and Backswimmer

These two interesting insects are very common in our ponds. You can even find them in your backyard swimming pool! They look very much alike with long powerful swimming legs resembling oars. The noticeable difference between these two insects is the way they swim. The backswimmer generally swims upside down.

Water Boatman



Water Boatman Larva

Backswimmer

If you are collecting giant water bugs, backswimmers, and water boatman for study and release, be careful how you handle them. These insects may bite causing painful swelling.

Postcroakers

1. Why is putting oil on pond water a way of controlling mosquitoes?
2. What other insect might be killed by this practice?
3. How do diving beetles breathe while under water?
4. Why is the diving beetle called predaceous?

LARGER ANIMAL LIFE OF THE POND

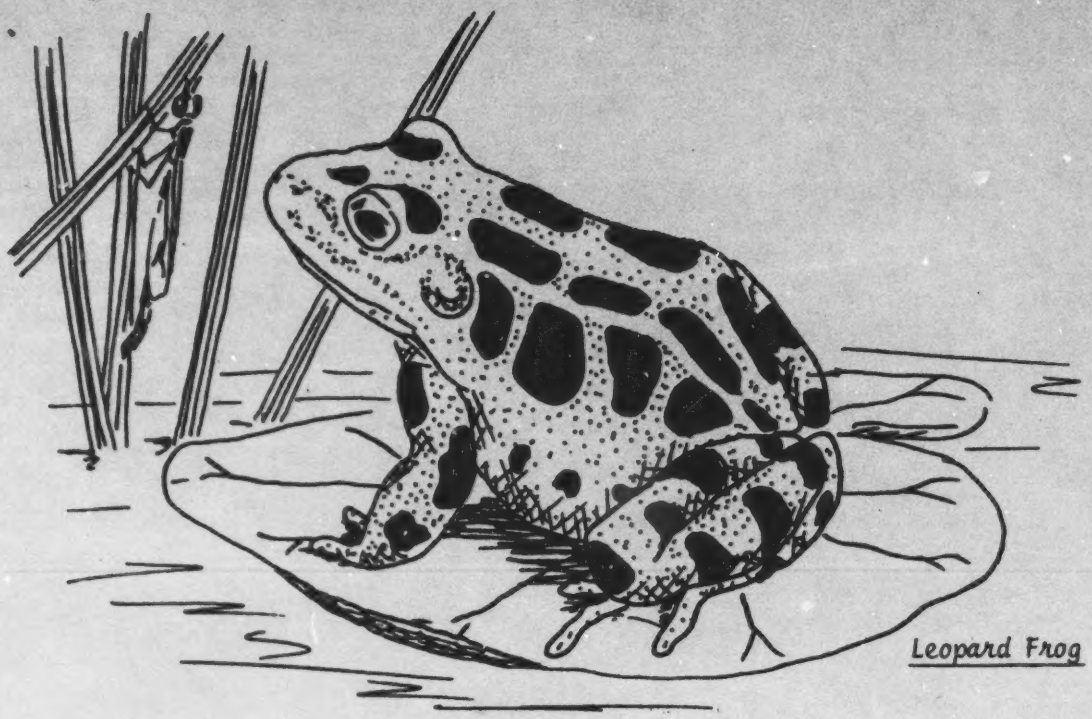
Precroakers

1. Why does a pond attract some of the larger animals?
2. Are water snakes poisonous?
3. What is an amphibian?
4. What do frog eggs look like?
5. What is a tadpole?
6. What happens to the tadpole's tail as it develops?
7. Which turtle is the most dangerous?
8. How can frogs breathe on land?
9. How do frogs breathe while under water?
10. How do frogs capture food?
11. What does a leopard frog have in common with a leopard?

When a pond is healthy and there is plenty of animal life, the larger pond animals can be found. Frogs, water snakes, turtles and fish are some of the more common animals in this group.

Frogs

Two different kinds of frogs most frequently found in the ponds of northern Ohio are the green frog and the leopard frog. On occasion, you may find a bull frog. It is the largest of our frogs and its legs are considered a delicacy to eat. Being able to breathe through wet skin or lungs is a unique quality that permits the frog to live in the water and on land. This amphibian provides a chorus of sounds we have learned to identify with a pond setting.



Leopard Frog

The female leopard frog found in Ohio ponds usually lays her eggs between the first of April and the middle of May. The eggs are fertilized by the male as they are laid. When you find frog eggs in a pond, they will be a jelly-like mass.

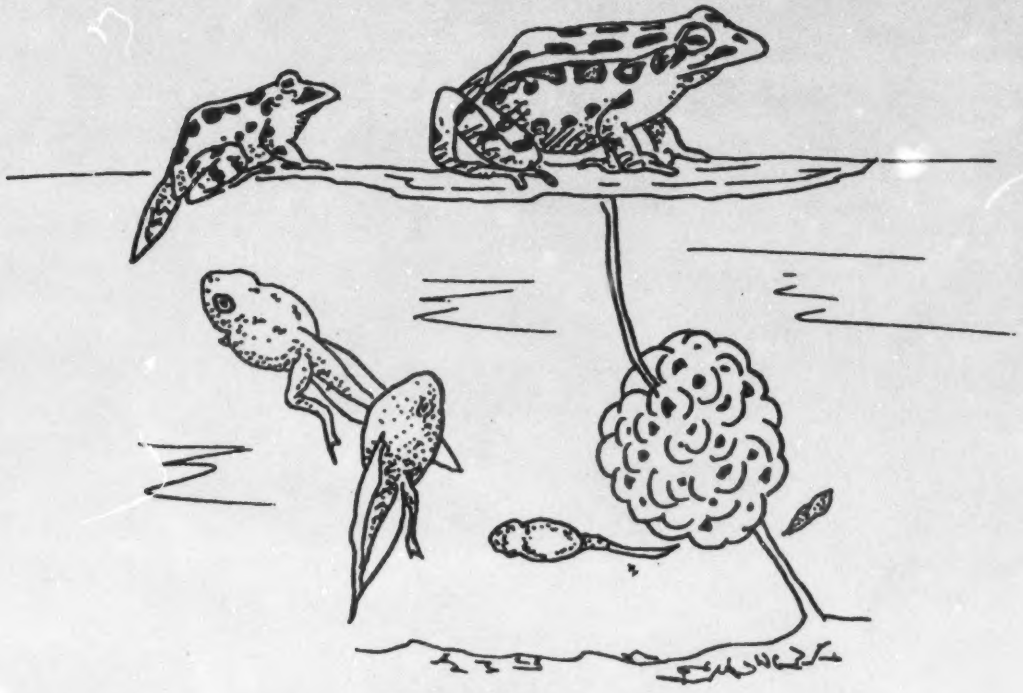
Frog Eggs

Green Frog

Frogs exhibit excellent protective coloration. Did you ever hear a frog croaking and try to find it?

The tadpole is the larva stage of the frog. Just after it hatches, the tiny tadpole clings to the egg-mass or a plant. The yolk of the egg is stored in the body of the tadpole and provides food until it starts to feed. The tadpoles soon become free swimmers and feed on decaying vegetation.

As the tadpole develops into a frog, the back legs appear first, then the front legs appear. The tail slowly disappears and becomes part of the body. Even before the tail is completely gone, the young frog can leave the water and live on land.



Life Cycle of a Frog

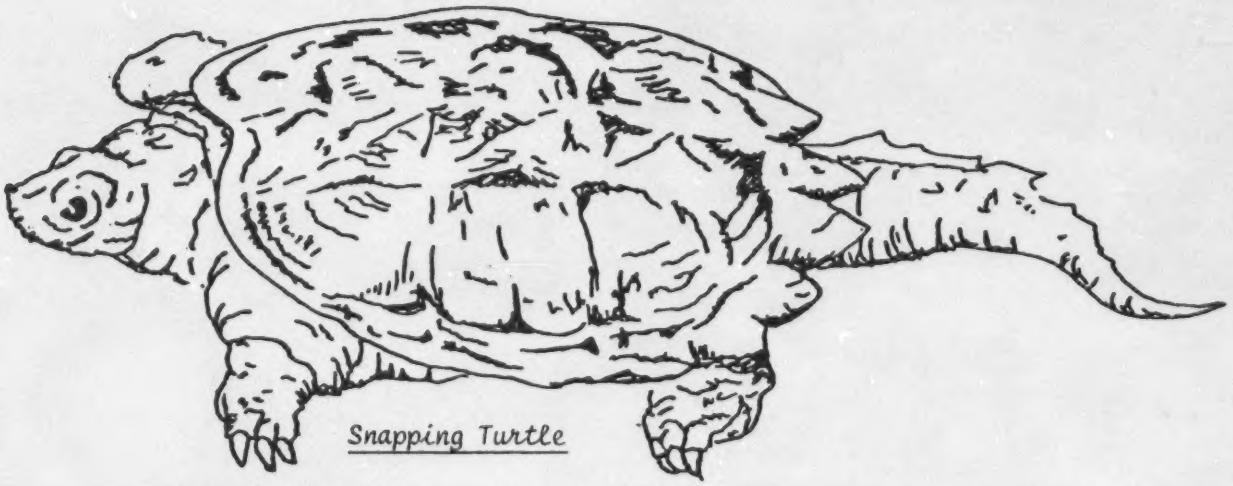
The entire process from a newly hatched leopard frog to a full grown frog normally takes sixty to ninety days. Some frogs, such as the bull frog, spend two or three years maturing.

Snakes

Small land animals are plentiful near ponds because necessary water is there. These small animals such as insects, salamanders, moles, and mice are a source of food for snakes. At least one type of snake, the common water snake, makes its home near a pond and feeds on frogs and fish. Although it lives on land, it seeks water when frightened or searching for food. This snake is not poisonous, but it is shy and can be vicious. Because water snakes live in and near the water, they are sometimes confused with the extremely poisonous southern cottonmouth.

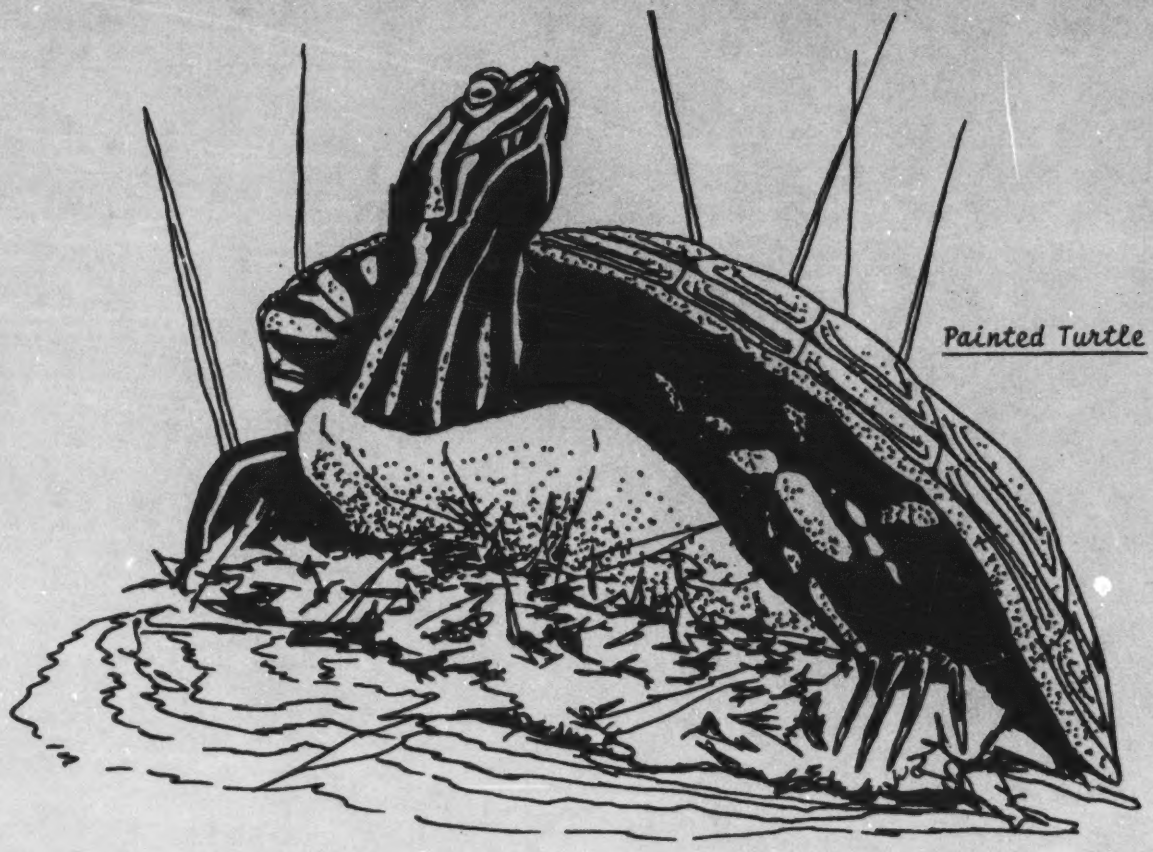
Turtles

Most ponds in the Cleveland, Ohio region serve as a home for at least two different kinds of turtles. The first is the snapping turtle, a pond resident that should be avoided. Its vicious temper and powerful jaws make it unsafe to handle.



Snapping Turtle

Some people think that turtle soup and turtle meat is a delicacy. They say that some turtle meat tastes like chicken, some like turkey, some like beef and some like pork.



Painted Turtle

The most common turtle of ponds and marshes is the painted turtle. It is shy and not easily captured, but you can often see it sunning on logs in marshes and ponds.

Turtles feed on frogs, fish, crayfish, small ducks, and other animals that frequent their water habitat. They lay eggs along the shorelines, which are then warmed by the sun and hatch in two to three months.

Precroakers

1. How is the frog's tongue different from ours? Why?
2. What really happens to the tadpole's tail?
3. Are turtles good to eat?
4. Is it an advantage for the underside of a frog to be white? Why?
5. How long can a snapping turtle live?
6. How big can a snapping turtle grow?
7. Can a frog drown?

DOWN AT THE OLD POND

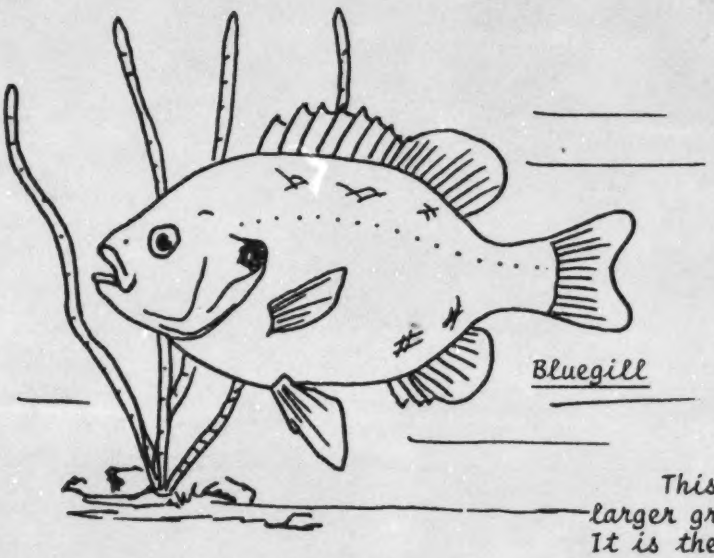
POND FISH

Precroakers

1. What is a panfish?
2. What fish can live in a pond?
3. What are two pond fish that are scavengers?
4. What pond fish do you think is tastiest?
5. What bait would be good if you are fishing for bass?

Most boys and girls like fishing. It is a sport that one can enjoy during an entire lifetime. Many people caught their first fish in a local pond Such ponds are often "stocked" with fish by conservation-minded people. Ponds in which there is a good balance of fish and natural food produce fish that are healthy and fast-growing. Ponds where there are too many fish and a shortage of food produce "stunted" fish. Such fish never grow very large and are a good example of the need for pond management in which population is controlled.

A properly-managed pond will have in it several different kinds of fish. Some of these fish, such as the bluegills, serve as food for larger fish such as bass. Thus, one type of fish controls the population of another.



Bluegill

This fish belongs to a larger group called sunfish. It is the largest sunfish and can weigh as much as one pound.

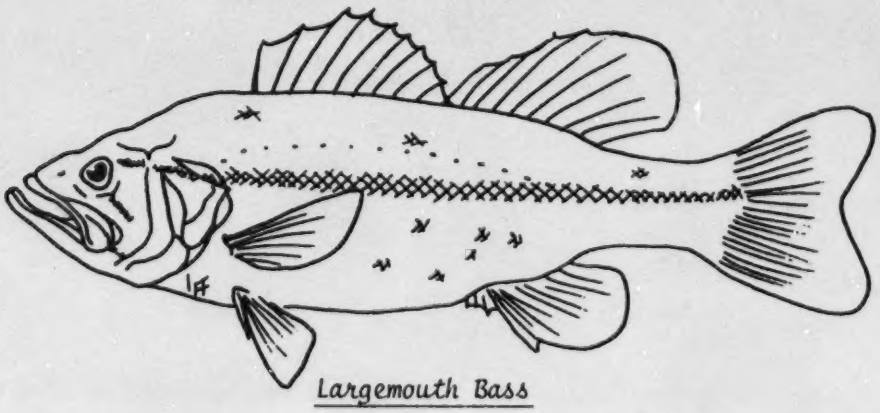
The Bluegill

Bluegills are the most plentiful fish in our local ponds. They are members of the sunfish family. If the food supply is plentiful, they will weigh as much as one pound when fully grown. They prefer worms and insects as food; but they, in turn, are eaten by larger fish such as bass and catfish.

Bluegill fishing is a very popular sport in the inland lakes throughout Ohio. These fish are among a group fishermen call "panfish" and some people think the bluegill is the tastiest fish for eating.

Bass

Many fishermen feel that the bass is the finest freshwater game fish. When caught it often "fights" by leaping out of the water. There are two primary kinds of bass found in Ohio. The smallmouth bass is most often found in cooler waters near Cleveland and Lake Erie. It originally was a native of northeastern United States, but can now be found in Canada and throughout the western United States. The smallmouth bass does not live successfully in the warm waters of the Gulf Shores.



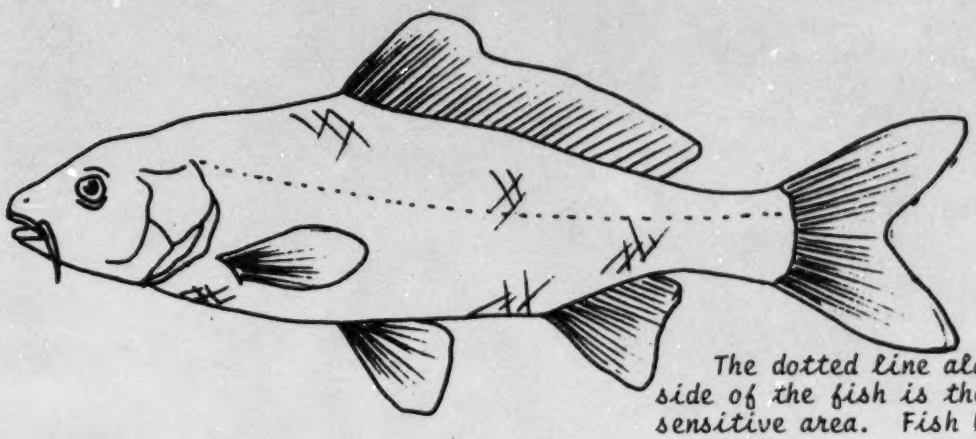
Largemouth Bass

Fishermen prize this fish for its fighting ability.

The largemouth bass can be found in our region, but prefers the warmer waters of the south. This bass grows to a larger size than the smallmouth and is a very successful fish in the farm ponds of Ohio.

Bass lay their eggs in a nest scooped out of gravel. Once the eggs are laid by the female, the male fertilizes them and stands guard until they are hatched. The favorite diet of the bass consists of minnows, worms, frogs, and insects. They are often caught on artificial lures that resemble these preferred foods.

Carp



The dotted line along the side of the fish is the sound sensitive area. Fish have no ears.

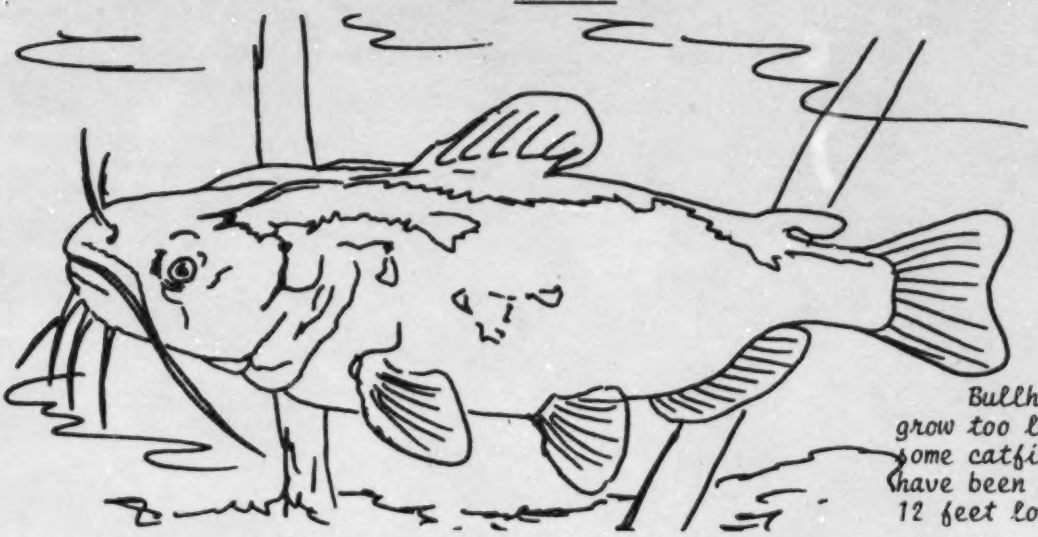
Carp were brought to Europe from Asia and from Europe to America in the 1800s. They reproduced and grew so successfully in the United States that they are now found from coast to coast in lakes, ponds, and slow-moving rivers and streams.

Carp are bottom-feeders, living primarily on insects and dead animal life. They are sometimes considered the scavengers of the water and can grow up to three feet long and weigh as much as thirty pounds.

In some countries, like Japan, the carp is considered an important food fish. On certain holidays, large kites resembling carp are flown from Japanese roof tops. There is a kite for each child in the family.

Carp are used as a primary source of food in many parts of the world. They are easily raised in ponds and not too selective in the types of food they will eat. Some students will probably remember how eagerly the carp will eat bread when it is tossed to them in ponds and lakes where carp are plentiful (Pymatuning Lake, Cedar Point Lagoons, etc.).

Catfish



Bullheads never grow too large, but some catfish in Europe have been reported to be 12 feet long.

Bullhead

Catfish can be found in Lake Erie and ponds and streams throughout Ohio. In the southern part of the United States, they are considered a delicacy and can be found on the menus of some of the best restaurants.

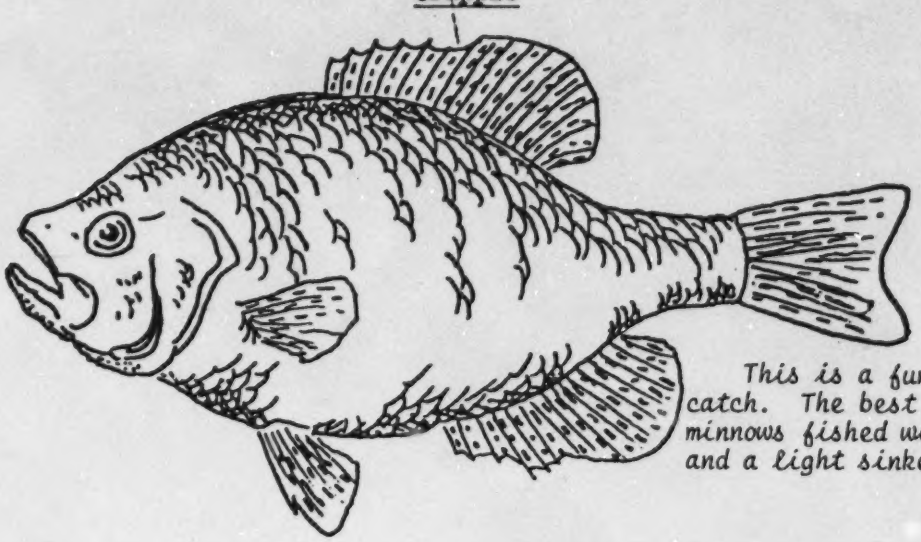
Most of the catfish that are caught in ponds are a type called bullheads. The bullhead is a small catfish which rarely grows to a length of one foot or weighs over two pounds. They live in muddy ponds and streams and may survive in mud even when the ponds dry up during dry spells. They feed on almost any kind of plant and animal life they can find on the bottom and are particularly fond of worms, snails, crayfish, insects, and minnows.

Bullheads lay their eggs in the spring in a nest scooped out in the hard bottom of a pond, lake or stream. The male watches the nest and guards the young once they hatch.

Catfish may get as large as twelve feet long (found in Europe) and the blue catfish found in the Mississippi watershed can weigh as much as 150 pounds.

The whiskers near the mouth of the catfish are called barbels. Due to their well-developed sense of touch, the barbels help the fish feel in much the same way as our fingers help us in feeling by touching. Catfish also have sharp spines on their fins. These spines not only hurt when they are touched, but can cause irritation and infection if they penetrate the skin. It is important to be careful when taking a catfish from a hook.

Crappie



This is a fun fish to catch. The best bait is minnows fished with a bobber and a light sinker.

There are two kinds of crappies, the black crappie and the white crappie. Both live successfully in ponds. They feed on small water animals, insects, and small fish. These panfish can be caught through the ice in winter and near the pond shoreline in early spring. They often grow to be twelve inches long and can weigh as much as two pounds. Crappies are considered excellent eating and are fun to catch with such simple fishing tackle as a cane pole.

Postcroakers

1. What two fish feed on the bottom of the pond?
2. What fish often feed on the surface?
3. What can be done to prevent stunted fish?
4. Which fish has no scales?
5. How can you tell the age of most fish?
6. Do fish have ears?

OCCASIONAL POND DWELLERS AND VISITORS

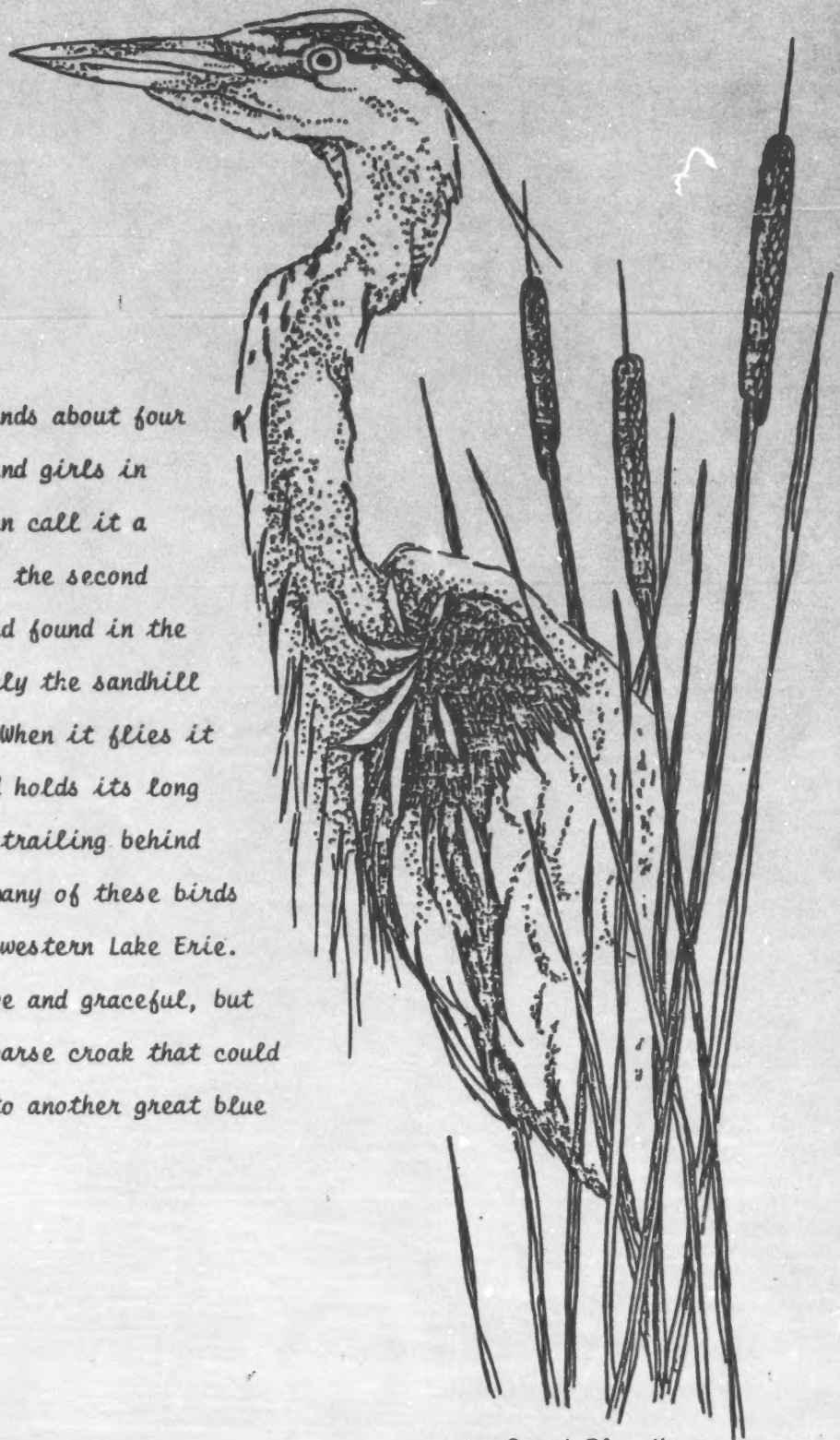
Precroakers

1. What mammals frequently visit the pond? Why?
2. What mammals often make their homes along the shoreline?
3. How do duck beaks and wading birds beaks differ? Why?
4. How do the legs of wading birds differ from most other birds?

Up to now, we have been interested in animals and some plants that live on the surface of the pond or in the pond water. Whenever we visit a pond and sit quietly on its banks, we may observe a number of animals flying or running about in their search for food.

Birds

Birds that feed in or near the pond are of particular interest. There are some birds that wade in the water while feeding on fish, snails, and insects. Some of these birds are American bittern, little blue heron, black-crowned night heron, green heron and the great blue heron.



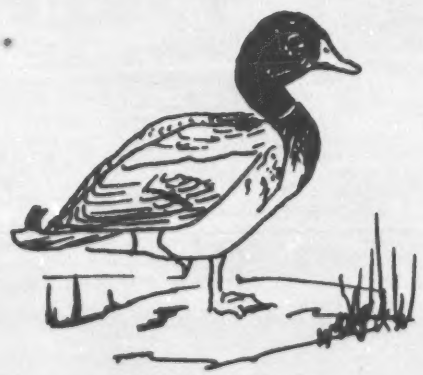
Great Blue Heron

This bird stands about four feet tall. Boys and girls in southern Ohio often call it a "Shy-Poke." It is the second largest wading bird found in the United States. Only the sandhill crane is larger. When it flies it folds its neck and holds its long legs straight out trailing behind it. You can see many of these birds in the marshes of western Lake Erie. They are attractive and graceful, but their call is a hoarse croak that could only be pleasant to another great blue heron.

American Bittern

Black-Crowned Night Heron

There are also birds that swim on the water feeding near the surface or diving for food. A few examples are the American coot, wood duck, mallard duck, black duck, and grebes.



Mallard Duck

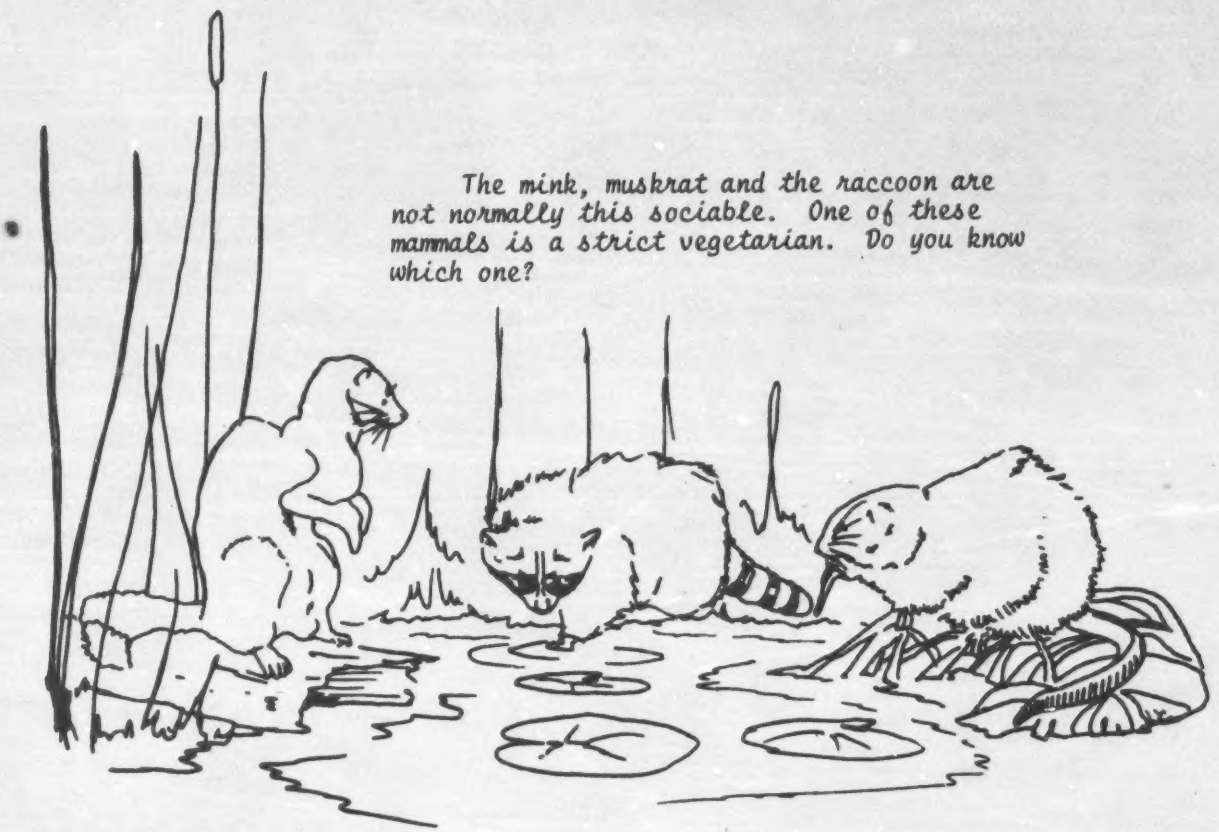
Wood Duck

Most of the birds mentioned are only occasional visitors to a particular pond. When there is ample food supply, some nest there.

Along the shoreline, one might see kingfishers diving for minnows, red-winged blackbirds perched on cattails, and swallows swooping over the water while they catch insects.

Mammals

Many mammals visit the pond for water and food. Ponds are favorite haunts for such animals as mink, raccoon while mice and muskrats make their homes along the bank.



The mink, muskrat and the raccoon are not normally this sociable. One of these mammals is a strict vegetarian. Do you know which one?

Perhaps no other habitat provides food and shelter for so many different animals as does the pond. It is indeed an active community.

Postcroakers

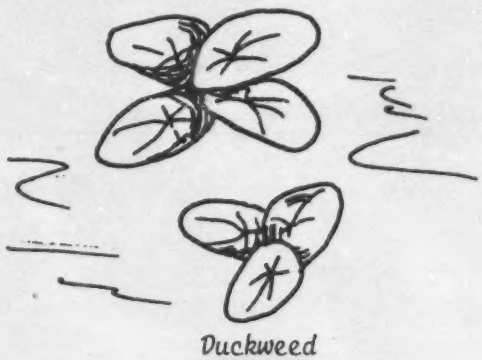
1. What type of a nest do wading birds build? Where do they build them?
2. Where does the wood duck nest?
3. Why do the mink and raccoon visit ponds?

COMMON AQUATIC PLANTS

Precroakers

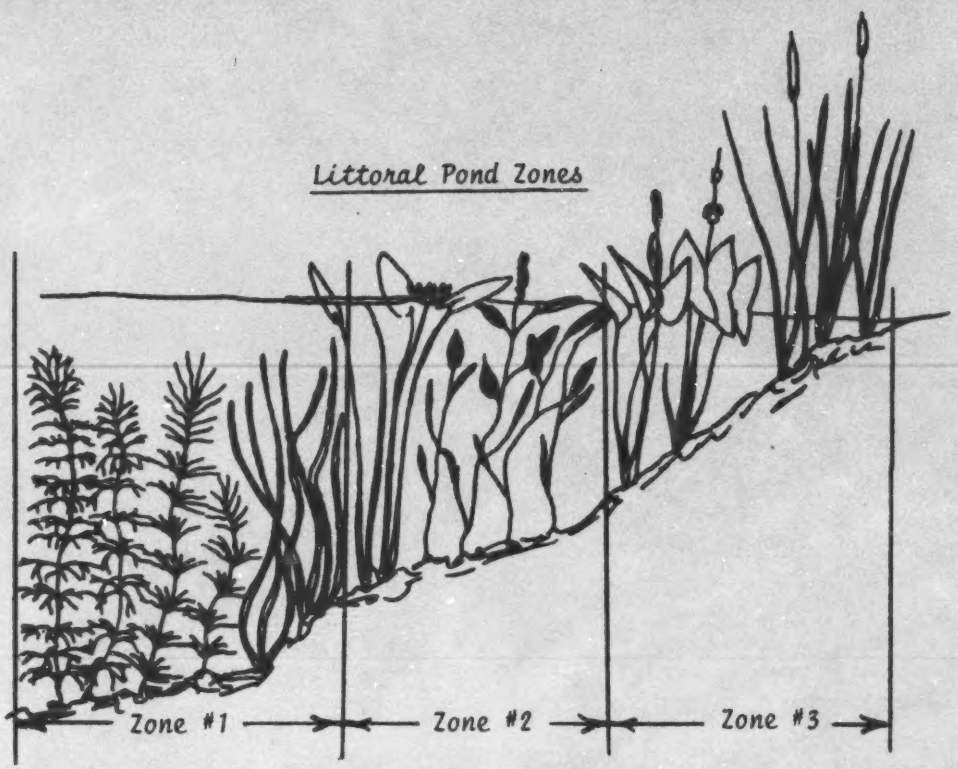
1. What plants grow beneath the surface of the water?
2. What plants found in a pond are often sold as aquarium plants?
3. What plants root in the pond bottom but have leaves that float on the pond's surface?
4. What plants root in the pond bottom but extend above the pond's surface.

On the surface of almost every pond lives a small floating green plant called duckweed. The duckweed found in ponds near Cleveland is approximately 1/3 inch long. It floats on the surface with tiny roots hanging down into the water. Sometimes the duckweed is so thick on a pond that people think it is covered with algae. Such a thick cover of duckweed makes it impossible to fish because the line, hook and sinker will not sink through the plants. Under such conditions, small birds can walk on the surface of the duckweed without falling through!



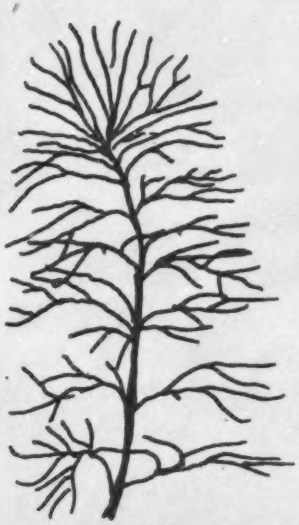
Duckweed

Duckweed is not a large aquatic plant, but it is much larger than the diatoms and algae we have mentioned earlier. The larger plants of a pond live in zones. Each zone contains a different group of plants as shown in the next illustration.

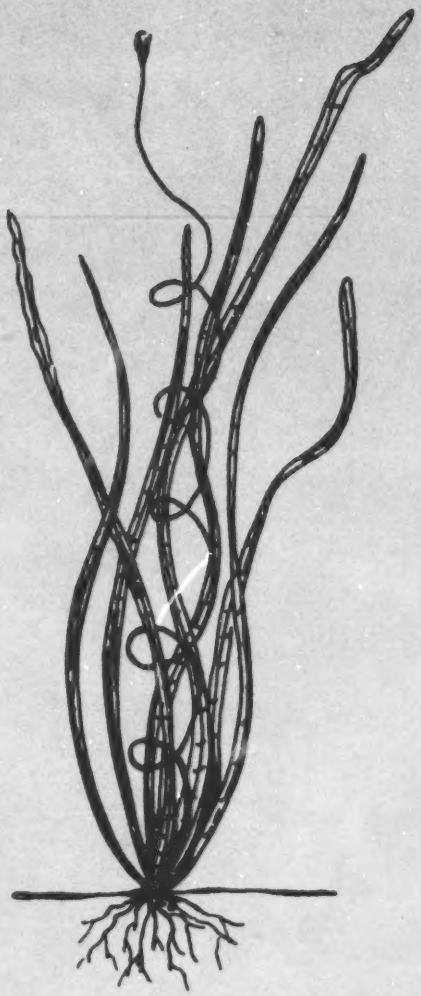


Let us imagine that we are canoeing and that you are in the middle of a pond, in water too deep to permit larger plants to grow. As you approach shore and look down into the water, you will probably see plants growing beneath the canoe. These plants are submerged and can live in water where sufficient light penetrates to the pond floor. We call this Zone #1. A selected few of these plants most commonly found in the ponds of northern Ohio are illustrated. Two names are given for most plants. The first name is the scientific name while the name in parenthesis is the common name.

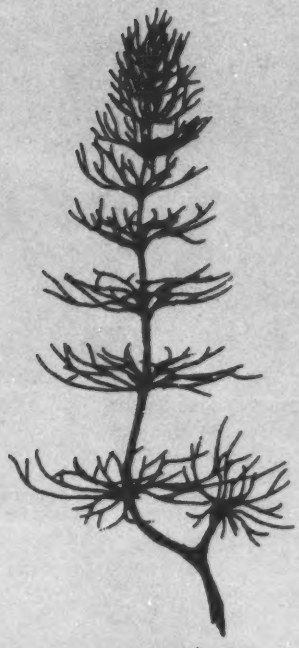
Elodea
(waterweed)



Cabomba
(fanwort)



Vallisneria
(eel grass)

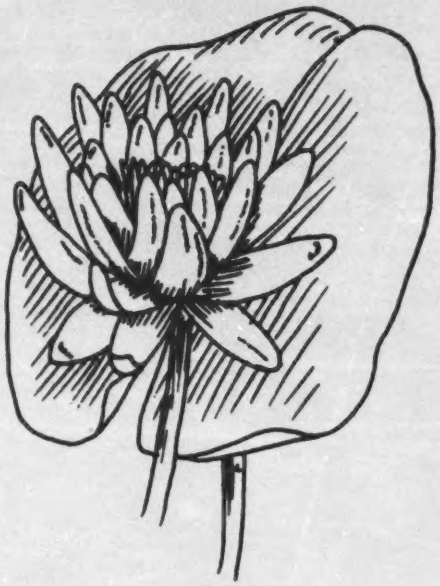


Ceratophyllum
(coontail or hornwort)

As you pass over Zone #1 and enter Zone #2, you may find plants that are rooted to the bottom of the pond but their leaves float on the surface. These water plants are among the most valuable food sources for animals and include some of the most attractive pond flowers.

Pondweed is an important food source for water fowl. It is eaten by coots, swans, geese, most of our ducks and shorebirds. In the north, even the moose depend on this plant as a food source. Virtually every part of the plant is eaten by some animal. This includes the seeds, stems, leaves, and roots.

Potamogeton
(pondweed)

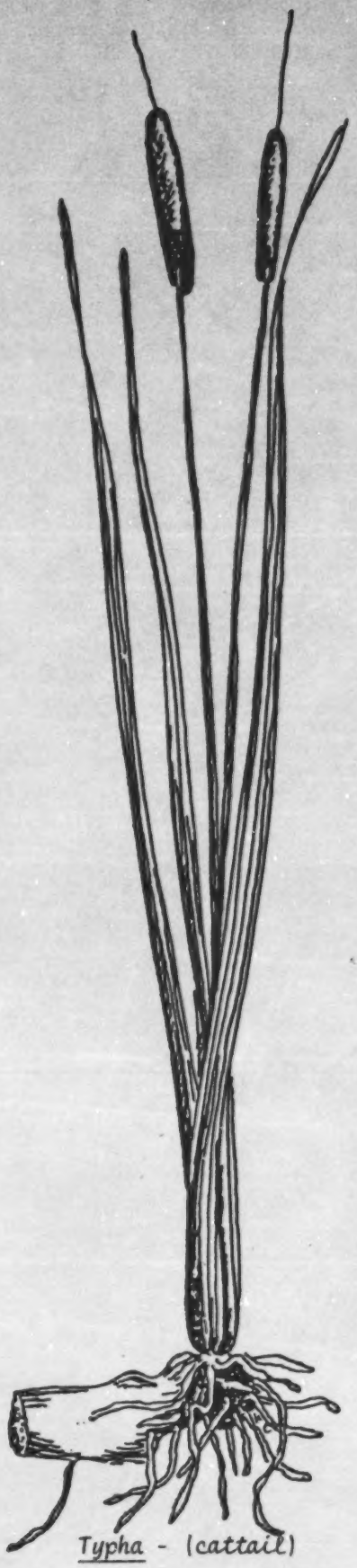


Nymphaeu
(white water lily)

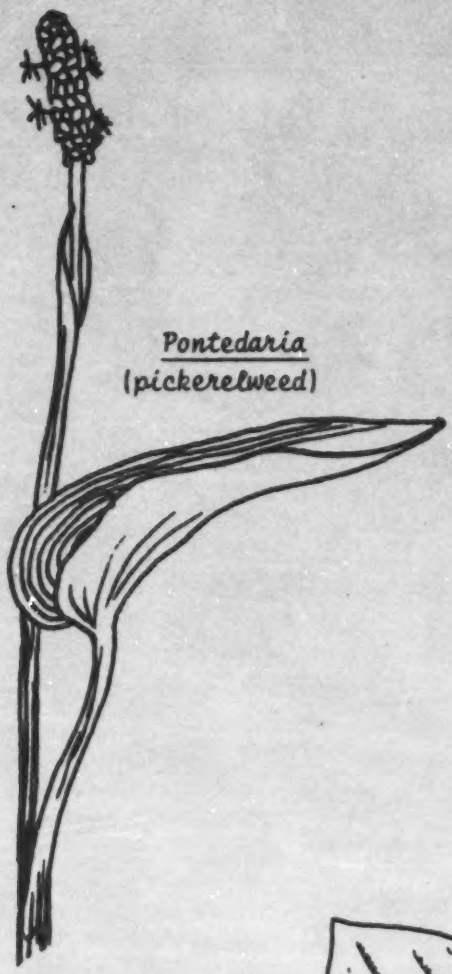
Perhaps you have seen the white water lily. This Zone #2 plant is among the most graceful and attractive of the pond plants. The large white blooms and floating leaves are an invitation to any photographer who enjoys taking pictures of wildflowers.

As you canoe through Zone #2 and enter Zone #3, you will find the plants that have a root system anchored in the bottom of the pond and leaves and flowers extending above the water's surface. Among these plants are cattail, pickerelweed, and arrowhead.

Zones #1, #2, and #3 make up the littoral zone of a pond. It is easy to understand why this zone is so abundant in animal life. Not only do the plants supply food for animals but they also provide protective covering.



(43) *Typha* - (cattail)



Pontedaria
(pickerelweed)

Pickerelweed produces a large blue flower. Its flower and leaves extend above the water's surface.

The leaves and white flowers of the arrowhead also extend above the water's surface.

Sagittaria
(arrowhead)

As you beach your canoe, you step onto the first land zone. This is a zone of grasses and marsh plants such as sedges. Further up the bank, we find the shrubs that make up the second land zone and finally, as we walk away from the pond, young forests begin to form the third land zone.

The interesting thing about these zones of the pond region is that as the pond matures and decaying matter fills the bottom, Zone #1 becomes Zone #2, then Zone #3, etc. As the zones change, the plants that are characteristic of each new zone appear. We call this gradual development ecological succession. If uninterrupted, a pond will eventually become a marsh and the young forest becomes a mature forest.

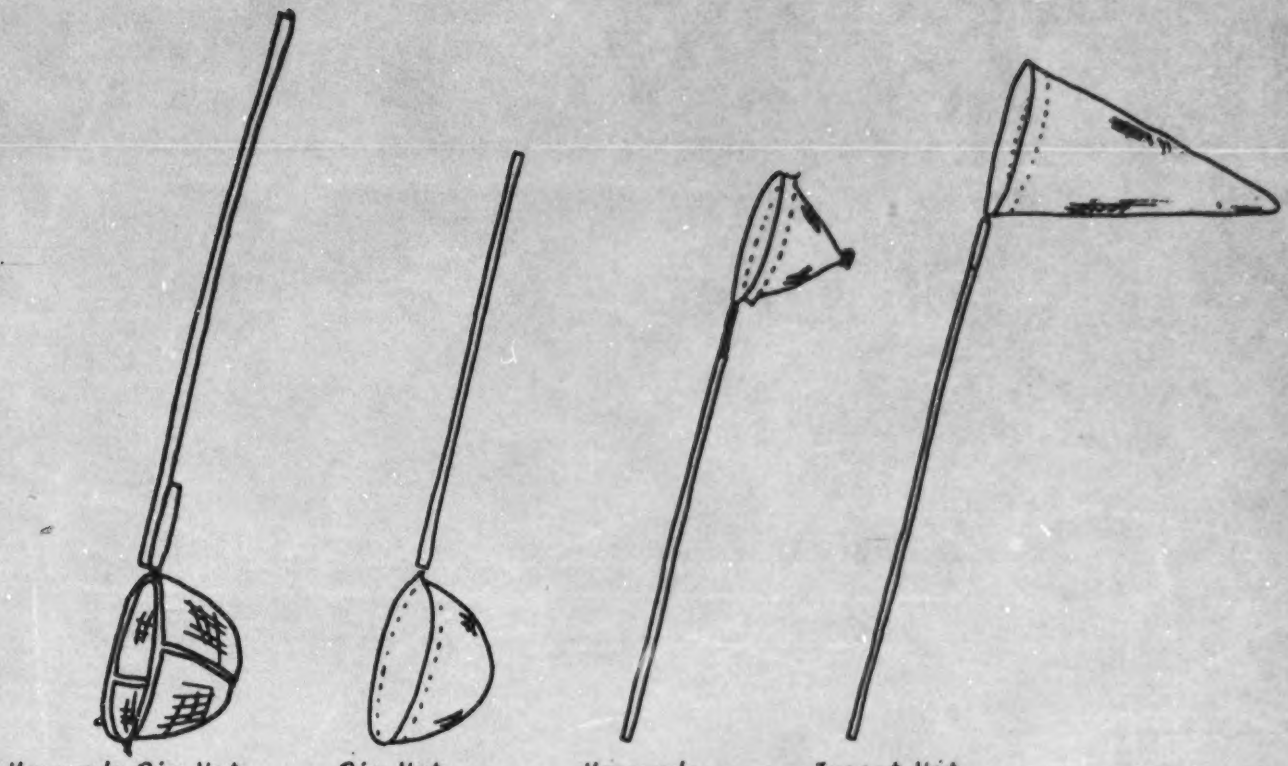
Postcroakers

1. What are the characteristic plants in Zone #1?
2. What are the characteristic plants in Zone #2?
3. What are the characteristic plants in Zone #3?
4. What do we mean by the ecological succession of a pond?

CAPTURING POND INSECTS

If you find ponds interesting and have studied this booklet, the next time you visit a pond, you may wish to attempt to collect and release some of the aquatic insects mentioned earlier. Be sure that when you are attempting to capture aquatic insects that you do not undertake this task alone. Always use a "buddy system" and have someone with you at all times. This is also true when you are visiting a pond while on a class field trip.

Should you wish to net aquatic insects, aquatic nets are generally available through your school, or they can easily be made by using a large kitchen strainer attached to a broomstick.



Homemade Dip Net

Dip Net
Commercial

Homemade
Insect Net

Insect Net
(A commercial net used for capturing flying insects.)

If you wish to capture flying insects, you will need to use an insect net. These may be available through your school or made by attaching nylon netting to a wire hoop which is then attached to a broom handle. Further instructions on how to make collecting nets can be found in most insect books.

POND FOOD CHAINS

Precroakers

1. What is a producer? Give an example.
2. What is a consumer? Give an example.
3. What is a food chain? Give an example.
4. What is a decomposer? Give an example.
5. What is an ecosystem? Give an example.

Living things are sometimes grouped by the way they get their food. A very important group is the producers consisting of green grass, green trees, green vegetables, etc. All members of this group contain chlorophyll which uses the energy from sunlight to make food. This food produced by green plants supplies all the other living things with the food that they need. It is little wonder that they are called producers.

Living things that do not manufacture food are called consumers. They eat the food that plants produce or they eat animals that eat plants. These consumers belong to other smaller groups such as plant eaters, flesh eaters, scavengers, animals that eat both plants and flesh, and decomposers (bacteria and fungi which help cause decay).

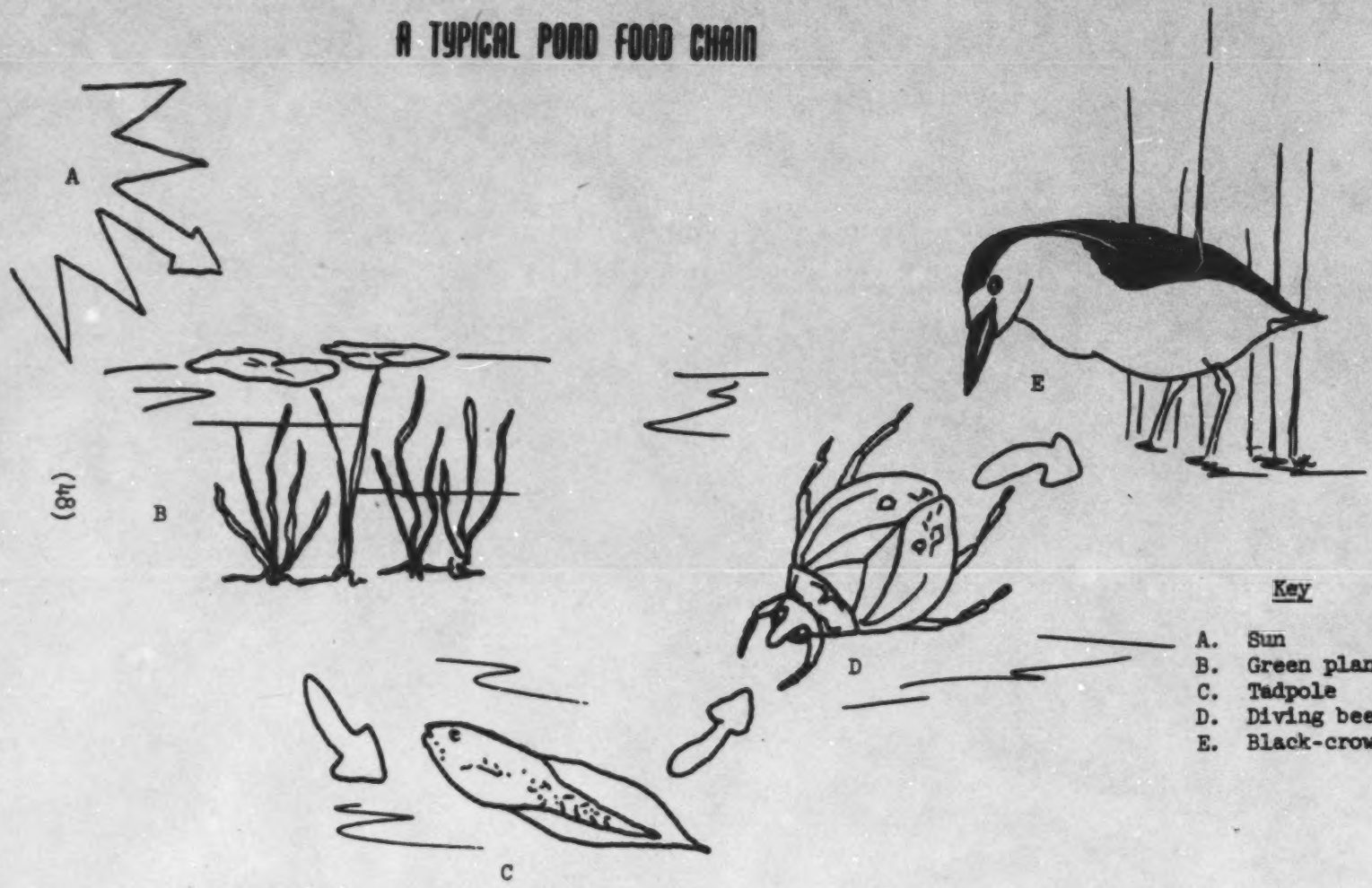
Food that is produced by plants may be eaten by plant eaters. Plant eaters are then eaten by flesh eaters. The flesh eaters die and are then used as food by scavengers or decay and provide nutrients for new plants. When food is passed along in this way, we call the process a food chain.

On the following page is a drawing of a simple food chain characteristic of a pond. The sun (A) supplies the energy for the plants (B) to grow; the tadpole (C) eats the dead plant material; the diving beetle (D) eats the tadpole and the black-crowned night heron (E) eats the diving beetle.

This example of a food chain is only one of a number in the pond community. You can probably think of several more. The many possible food chains are due to the numerous different plants and animals that live there.

In a way, a pond community is like a little island where everything needed to support life is found. Sunlight, oxygen, food, shelter, and water are all available to the producers and consumers living there. Such a self-sufficient area is called an ecosystem. It is easy to conclude that the word ecosystem is related to the study of ecology which is defined as the study of living things in their "homes" or environment.

A TYPICAL POND FOOD CHAIN



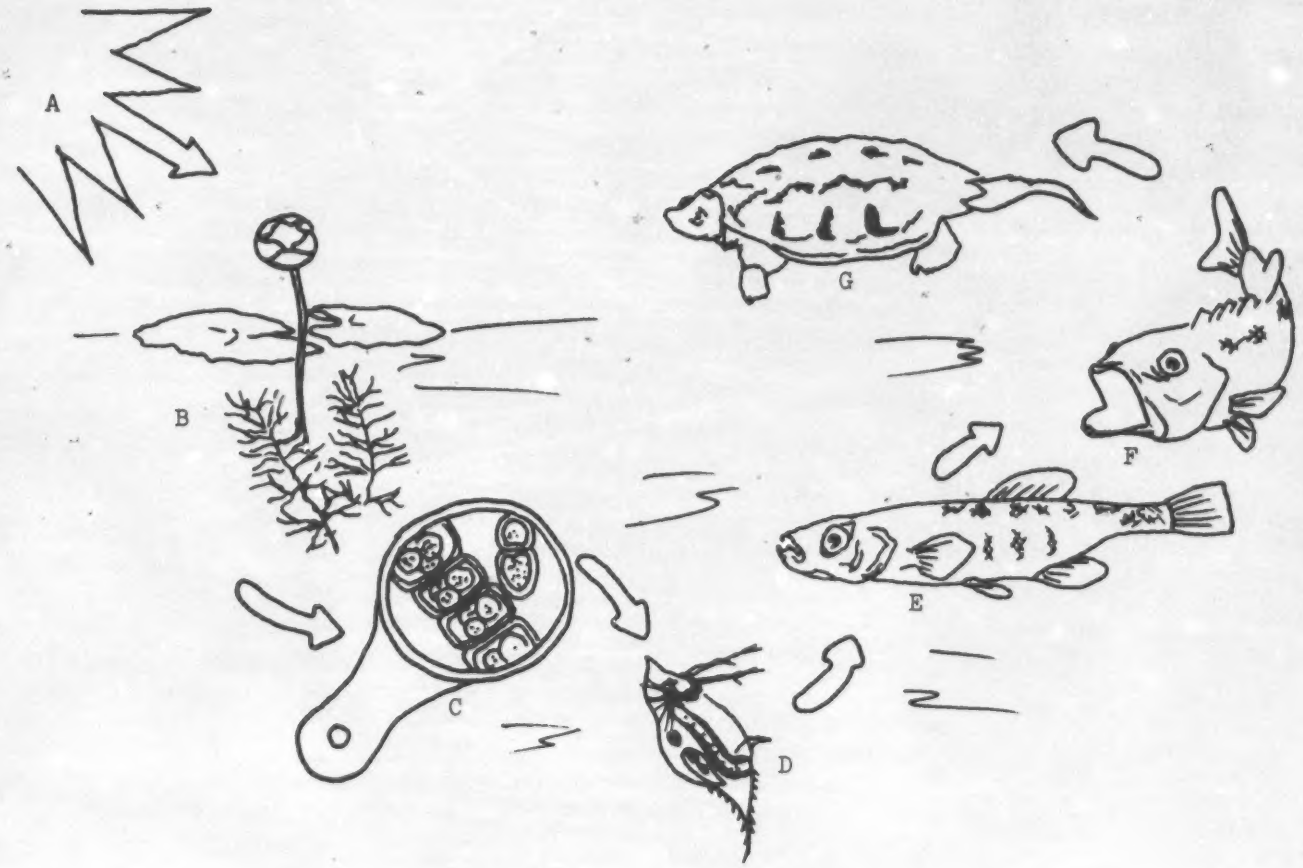
Key

A. Sun
B. Green plants
C. Tadpole
D. Diving beetle
E. Black-crowned night heron

··Which is the producer?
··Which is the consumer?
··Can there be more than one type of producer?
··What happens to this food chain beyond the heron?

Postcroakers

1. What are members or this food chain?
2. How does each contribute to the chain?
3. What happens to the food chain beyond the turtle?
4. What is the study of ecology as you now understand it?
5. Can you draw your own pond food chain?



If you have studied and understood the content of this book, you now have some knowledge of the basic ecology of the pond community. You understand that the pond is only one of the many types of ecological communities that exist in nature and, like all communities, it functions best when it is free from pollution and thoughtless abuse. Ponds require little care and can provide a great deal of enjoyment to those who understand the nature of pond life and are willing to quietly observe pond happenings.

Hopefully, you agree that a pond is an exciting place to visit and study. Your increased knowledge of pond ecology should assist you in observing and interpreting this ecosystem in a more scientific and knowledgeable way.

THE END !

GLOSSARY

algae:	very simple green plants; may be one-celled or many-celled
amphibian:	animals that can live on land or in the water
aquatic:	refers to living in a water habitat
bacteria:	single-celled microscopic plants that lack chlorophyll; cause decay, disease, and fermentation
carbon dioxide:	a colorless, odorless gas present in the air in small amounts; given off by animals as they use food for energy
chlorophyll:	the green material in plants that promotes the production of food
cilia:	hair-like threads on animals that help them move or collect food
cold-blooded:	a term used to describe animals whose body temperature changes as the temperature of their environment changes
collecting vial:	a small container used to collect biological specimens
community:	a part of the environment set off from other parts by natural barriers
complete metamorphosis:	the four stages of development in certain insects: egg, larva, pupa, and adult
consumer:	animal that eats plants or other animals
crustacean:	animal with an exoskeleton such as the crayfish
decay:	change of dead plant and animal matter to simple substances: decomposition
decomposer:	plant that breaks down dead organisms into simpler substances
ecological succession:	the changing plant and animal life in an area
ecologist:	one who studies the interdependence of plants and animals
ecology:	the study of the relationships of living things to their surroundings
ecosystem:	groups of organisms together with their non-living environment

exoskeleton:	the hard outer covering, or skeleton, of some animals, such as insects and crayfish
fertilize:	the joining of a male and female sex cell
food chain:	a series of plants and animals which are dependent, one on the other, for food
fungi:	non-green plants that are unable to make their own food; they help in the decay process
habitat:	a place where an animal lives
incomplete metamorphosis:	life stages of some insects consisting of egg, nymph, and adult
insect:	an animal with six legs and 3 body regions, with antennae and, occasionally, wings
larva:	the usually worm-like and wingless stage in the life cycle of certain insects, just after they hatch from the egg
littoral zone:	that area of the pond where plants grow
molting:	shedding of the outer layer, or exoskeleton, of certain animals such as the crayfish
nitrates:	a substance containing nitrogen and oxygen
nutrient:	foods such as starch, sugar, proteins, fats, vitamins, and minerals
nymph:	a stage between egg and adult in an insect having incomplete metamorphosis
open water:	that portion of the pond where large plants do not grow
organism:	a complete and entire living thing
oxygen:	a colorless, odorless gas of the air; needed by all cells to use food for energy
panfish:	a fish considered to be good for eating--of a size to fit a pan!
phosphates:	a substance containing phosphorous and oxygen; often present in fertilizer
photosynthesis:	a chemical process by which green plants, in the presence of sunlight and chlorophyll, change water and carbon dioxide into food
phytoplankton:	tiny green plants that float or drift in a pond

plankton:	a term used to describe tiny animal and plant life in a pond
pond management:	a way of regulating a pond community by wise use and careful planning; often involves adding desirable game fish
population:	a group of similar plants or animals
predator:	any animal which captures other animals for food
producer:	a green plant that produces food for animals to eat
protozoa:	simple one-celled animals
pupa:	the stage following the larva in an insect with complete metamorphosis: a resting stage
scavenger:	an animal that eats dead or decaying matter
shoreline:	the area of a pond where land and water meet
spider:	resembles an insect, but has eight legs instead of the six legs insects have
stocked:	introducing fish into a pond so they can grow and reproduce
stunted:	normal growth is disturbed, producing an organism of smaller than normal size
submerged:	below the water surface
vegetation:	plant life
zooplankton:	tiny animals that drift and float in pond water

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TEACHER GUIDE

A trip to the pond is a great adventure to most youngsters. The variety of plant and animal life found there is of particular interest due to specialized structures which permit them to live in a pond habitat. In addition, ponds are excellent for beginning ecology studies. They represent a closed ecosystem in which the interdependence of plants and animals is easily observed.

The Pond Community is an illustrated manual designed to be used with a magnetic board that serves as audio-tutorial support. It is primarily developed in a way that permits the study of such a community even when it is not possible to visit a local pond. However, to culminate the study of this book, a trip to a pond would be ideal.

This "Teacher's Guide" provides the type of information needed to use the pond materials with a minimum of difficulty. The "Precroaker" questions are designed to focus the student's attention on important factors he/she should note as the material is read. The "Postcroakers" are questions that help summarize the preceding materials and encourage students to look for information in other sources.

PART A

RESPONSES TO PRECROAKER AND POSTCROAKER QUESTIONS

Precroakers Page 2

1. Ponds are generally more shallow than lakes and not as large.
2. Green plants produce oxygen during photosynthesis. The oxygen is dissolved in the water and used by aquatic animals.
3. The zones referred to in this section are the area of a pond where oxygen is produced in quantity, the area where no oxygen is produced and the area where both oxygen and carbon dioxide are produced.
4. Temperature affects the amount of oxygen that can be dissolved in water. The colder the water, the more oxygen can be dissolved.

Postcroakers Page 4

1. Oxygen is needed in the decay process. If a great amount of material is decaying, the available oxygen in a pond is rapidly depleted.
2. The most oxygen is produced in the open water by phytoplankton.
3. More oxygen would be produced in clear water because the light can penetrate deeper.

Precroakers Page 5

1. Whirligig beetles and water striders are the two most common surface insects.
2. The whirligig beetle swims in a very disorderly manner.
3. The spider takes air beneath the surface of the water by trapping it with the fine hairs on its body.
4. The fisher spider eats insects and even small fish.

Postcroakers Page 7

1. The waxy coating on the hairs of the water strider's feet help keep it afloat.
2. He can see both above and below the water's surface at the same time.
3. Yes, the whirligig beetle dives below the surface of the water. It takes a bubble of air attached to its abdomen down with it as an oxygen supply.
4. The whirligig beetle eats insects that fall into the water.

Precroakers Page 8

1. Protozoa, planaria, bloodworms, snails and crayfish all can live on the bottom of a pond.
2. When plants and animals die, their remains fall to the bottom and serve as food for bottom dwellers.
3. The flatworm is a flat shaped animal that lives under rocks in ponds and streams. The particular flatworm mentioned is the planaria.
4. Snails eat dead plant materials.

Postcroakers Page 11

1. An exoskeleton is a skeleton of an animal that is located on the outside of the body.
2. Grasshoppers, beetles, other insects, lobsters, Cyclops, shrimp, crabs, and crayfish have exoskeletons.
3. Snails move about ten feet an hour by use of a flat muscular foot that secretes slime which helps it move over surfaces.
4. Snails and crayfish are both scavengers.
5. The crayfish is both a predator and a scavenger.

Precroakers Page 12

1. The littoral zone of a pond is that part where the larger plants grow.
2. Insects that undergo complete metamorphosis go through the stages of egg, larva, pupa and adult.
3. Some insects that undergo complete metamosphosis are: flies, mosquitoes, butterflies, bees, and ants.
4. When an insect undergoes incomplete metamorphosis, the stage between the egg and the adult is the nymph. Crickets, grasshoppers, dragonflies and damselflies undergo a nymph stage.

Postcroakers Page 14

1. The stages of incomplete metamorphosis are egg, nymph and adult.
2. Grasshoppers, crickets, roaches, dragonflies, damselflies and mayflies undergo incomplete metamorphosis.
3. When a dragonfly is at rest, its wings are spread horizontally. When at rest, a damselfly folds its wings over its back in a vertical position.
4. The dragonfly nymph eats insects and even small fish which it catches with its protruding and extremely strong jaw structure.
5. Dragonflies catch their food while flying. They fly over an insect and grasp it with their legs.

Precroakers Page 15

1. Phytoplankton are microscopic plants that float freely in water.
2. Zooplankton are tiny animals that contain one or more cells. Generally they can only be seen with the use of a microscope.
3. A finely woven net called a plankton net is needed to collect plankton.
4. The three main groups of zooplankton are protozoa, rotifers and crustaceans.
5. You can make a plankton net using a test tube, lady's hose and a coat hanger to form a hoop.

Postcroakers Page 19

1. Most plankton move by drifting in the water.
2. Zooplankton feed on smaller plankton and dead material. Green phytoplankton produce food by photosynthesis.
3. Algae helps the pond produce oxygen.
4. Algae are harmful to a pond because when they die and fall to the bottom, their decay uses up oxygen.
5. Daphnia and Cyclops are similar because they are both crustaceans and have exoskeletons.
6. If there are too many phosphates or nitrates in a pond, too much algae will grow. When these plants die and decay, they use up the available oxygen.

Precroakers Page 19

1. The largest air-breathing aquatic insect is the giant water bug.
2. The mosquito wiggler, mosquito pupa, water scorpion, giant water bug, predaceous diving beetle, water boatman and backswimmer must surface to breathe.
3. Water boatman, backswimmers and giant water bugs can bite and cause irritation.

Postcroakers Page 23

1. Oil forms a film over the water that keeps the breathing tubes of the mosquito larva and pupa from reaching the air.
2. All aquatic insects that live on the surface or must come to the surface to breathe may be killed when oil is placed on the water.
3. Diving beetles carry an air bubble on their abdomen when they submerge. The air is taken from the bubble through tiny breathing holes in the abdomen.
4. Predaceous diving beetles are so named because they prey on other animals.

Precroakers
Page 24

1. There is an ample supply of food for larger animals in and near a pond.
2. Water snakes are not poisonous and should not be confused with the southern cottonmouth snake.
3. An amphibian can live on land or in water.
4. Frog eggs look like jellied marbles each with a black spot in the middle. They are all joined together in a jelly-like mass.
5. A tadpole is the stage between the egg and an adult frog.
6. The tadpole's tail becomes a part of the frog's body.
7. Snapping turtles are considered very dangerous. They can seriously injure a careless person by biting with their powerful jaws.
8. Frogs have lungs and can breathe on land.
9. When frogs are under water, they breathe through their skin.
10. Frogs capture food with a sticky tongue that is attached to the front of the mouth.
11. Leopard frogs have spots. Leopards have spots.

Postcroakers
Page 28

1. The frog's tongue is fastened to the front of its mouth. It can "shoot" the tongue out at insects that become stuck on the tongue's sticky surface.
2. The frog's tail becomes part of its body.
3. Turtles are considered a delicacy by many people. Painted turtles and snapping turtles are often used to make soups. The meat of the turtle is fried in much the same way one would fry chicken.
4. The white underside of the frog blends into the sky when seen from below. This protects the frog from its enemies which includes fish and turtles.
5. Some snapping turtles can live as long as man.
6. Snapping turtles can grow to be as heavy as thirty-five to forty pounds.
7. A frog will drown if kept in an aquarium with nothing above the water's surface to crawl upon.

Precroakers
Page 30

1. A panfish is any small fish that can be fried whole in a pan.
2. The bluegill, carp, catfish, bass, and crappie are all fish that live successfully in a pond.
3. Carp and catfish are scavengers.
4. Some people think that the bluegill, crappie and bass are the best eating fish. In the south, catfish are the favorite of many people.
5. Soft shelled crayfish make excellent bass bait but minnows, worms, and artificial lures all work well.

Postcroakers Page 35

1. Catfish and carp are bottom feeders.
2. Bass and bluegill often feed on the surface of ponds. They eat the insects that fall in the water. A bass will eat a frog or even a small duck that is swimming on the surface.
3. A pond should be fished; the fish that are too plentiful should be removed. A pond that has an oversupply of bluegills may need to be stocked with catfish and bass. These fish will eat bluegills and help control the population.
4. Catfish have no scales.
5. You can tell the age of a fish by counting the growth rings on the scales. One ring is equal to one year of growth. A microscope or good hand lens is needed to make such a count.
6. Fish do not have ears but they do have an area along each side of their body that has nerve endings that are sensitive to changes in water pressure. Since sound waves travel through water, the changes in pressure caused by such waves are registered by these nerve endings.

Precroakers Page 35

1. Mink and raccoon often visit ponds; they are attracted to ponds because of the ample food supply found there.
2. Muskrats often live in the banks of ponds. They may also build houses in the shallow parts. These houses look like small brush piles.
3. Wading bird beaks are sharp pointed; they are well adapted for catching insects and fish. Duck beaks are flat and serve as sifters of bottom materials. They are also designed to eat plants and plant seeds.
4. Legs of wading birds are much longer than legs of other birds.

Postcroakers Page 39

1. Wading birds, such as herons, build nests of twigs in the tops of trees. Many such nests can be seen in the trees along western Lake Erie.
2. Wood ducks build their nests in hollow trees. Some people who own ponds put up boxes similar to large bird houses. Wood ducks will nest in these man-made structures.
3. Mink and raccoons visit ponds in search of food.

Precroakers Page 39

1. Some of the common plants that grow beneath the water's surface are: fanwort, eelgrass, hornwort, and waterweed.
2. All of the plants mentioned above can be purchased for use in an aquarium. The aquarium supply clerk would call them by their more scientific name; Cabomba, Elodea, Ceratophyllum, and Vallisneria.
3. Plants that root on the bottom and have floating leaves are water lilies and pondweed.
4. Pond plants that root in the bottom and extend above the surface are cattails, pickerelweeds and arrowheads.

Postcroakers Page 45

1. The characteristic plants in Zone #1 of a pond are those that are rooted to the bottom and grow beneath the surface.
2. The characteristic plants in Zone #2 are rooted to the bottom but have leaves and flowers that float on the surface.
3. The characteristic plants in Zone #3 are rooted to the bottom and extend above the water's surface.
4. As a pond matures and gets filled with dead plants that eventually decay, Zone #2 becomes Zone #1 and Zone #3 becomes Zone #2.

Precroakers Page 46

1. Producers are green plants that manufacture their own food and are eaten by animals.
2. Consumers are animals that eat green plants or other animals.
3. A food chain begins with green plants and continues through a series of consumers. At some point, the food chain ends in decay which supplies nutrients for new plant growth.
4. Decomposers are bacteria and fungi which help cause decay.
5. An ecosystem is an ecologically self-sufficient area in which plants and animals are interdependent.

Postcroakers Page 49

1. Sunlight, green plants, Daphnia, small fish, larger fish, and turtles are members of this food chain.
2. Sunlight provides the energy needed for green plants to produce food, Daphnia eats small plants, fish eat Daphnia, larger fish eat smaller fish and the turtle eats the larger fish.
3. The turtle can either die and provide nutrients for new plant growth or it can be eaten by another animal.
4. Ecology is the study of the interdependent relationship of plants and animals within their environment.
5. Students should attempt to draw their own food chain. Numerous possible chains exist within a pond community.

PART B

USING THE MAGNETIC BOARD

The magnetic board can be used in many different ways other than those suggested. The ability level of the student(s) should be the key factor in how and to what extent the board is used. The packet of laminated animal and plant illustrations contains a number of items not mentioned in the activities. Teachers who find this visual aid helpful may want to use the additional items to create new student activities. Students should be encouraged to suggest and attempt new ideas using the board.

The suggestions mentioned in this guide can best be implemented if the laminated material is distributed on a table in such a way that each item can easily be found. All of the items can be identified by the assigned number.

NUMERICAL INDEX OF LAMINATIONS

Zone #1 Plants (root on bottom; grow under water)

1. Cabomba (fanwort)
2. Ceratophyllum (hornwort or coontail)
3. Elodea (waterweed)
4. Vallisneria (eel grass)

Zone #2 Plants (root on bottom; leaves and flowers float on surface)

5. Nymphea (white water lily)
6. Potamogeton (pondweed)

Zone #3 Plants (root on the bottom; extend above the water's surface)

7. Arrowhead
8. Pickerelweed
9. Cattail

Surface Plant (floating)

10. Duckweed

Surface Dwellers

11. Fisher spider
12. Water strider
13. Whirligig beetle

Bottom Dwellers

14. Bloodworm
15. Crayfish
16. Leech
17. Paramecium
18. Planaria
19. Predaceous diving beetle larva
20. Snail
21. Stentor
22. Water boatman larva
23. Whirligig beetle larva

Littoral Zone Animals (animals in the plant areas of a pond)

24. Damselfly nymph
25. Dragonfly nymph
26. Mayfly nymph

Tiny Drifting Plants (phytoplankton)

27. Blue-green algae
28. Desmids
29. Diatoms

Tiny Drifting Animals (zooplankton)

30. Cyclops
31. Daphnia
32. Rotifer

Aquatic Insects That Breathe Air

33. Backswimmer
34. Giant water bug
35. Giant water bug with eggs
36. Mosquito pupa
37. Mosquito wiggler
38. Predaceous diving beetle
39. Water boatman
40. Water scorpion

Larger Animal Life

41. Green frog
42. Leopard frog
43. Painted turtle
44. Snapping turtle

Pond Fish

45. Bass
46. Bluegill
47. Carp
48. Catfish
49. Crappie

Pond Birds

50. American bittern
51. American coot
52. Black-crowned night heron
53. Great blue heron
54. Mallard duck
55. Pied-billed grebe
56. Wood duck

Flying Insects

57. Damselfly
58. Dragonfly
59. Mayfly
60. Midge

MAGNETIC BOARD ACTIVITIES

1. You will probably discuss The Pond Community on the basis of "Precroaker" and "Postcroaker" questions. Each series of questions is directed to specific topics and the animals and plants related to that topic.

   Place each plant and animal on the board as it is discussed. Be sure the plant or animal is placed in its proper habitat. Each group of plants or animals should be removed from the board after the "Postcroaker" discussion.

2. After the students have completed their study of the text, review the material by asking them to select from the animal and zooplankton laminations those that live in a particular portion of the pond. The student(s) should place the lamination on the board in the area where the animal is most likely to live. Suggested groups of animals are:

   a) animals that live on the pond's surface (#s 11 - 13)
   b) animals that live on the bottom of the pond (#s 14 - 23)
   c) drifting animals (zooplankton) (#s 30 - 32)
   d) aquatic insects that breathe air (#s 33 - 40)
   e) larger animal life - frogs, turtle, birds, etc. (#s 41 - 44)

3. At the completion of activity #2, review the material by asking students to select from the laminated plant drawings those that live in a particular portion of the pond. Be sure to include phytoplankton. The student(s) should place the plants on the magnetic board in the pond area most suitable for their growth. They should attempt to name each plant as it is placed in position. Suggested groups of plants are:

   a) free floating on the surface of the water (#10)
   b) free floating throughout the water (#s 27 - 29)
   c) submerged beneath the water's surface but rooted to the pond bottom (#s 1 - 4)

d) rooted to the pond bottom but with leaves and flowers floating on the surface (#s 5 - 6)
e) rooted to the pond bottom but with stems and flowers that extend above the water's surface. (#s 7 - 9)

4. Leaving the plants in place, ask the student(s) to place each animal that fits the following description or clue in its proper habitat. The answer is given for the convenience of the teacher.

a) A bottom feeder that is both a scavenger and a predator. (crayfish #15)
b) An insect that has waxy coated hairs on its feet. It lives on the pond's surface. (water strider #12)
c) The largest insect you will ever find in a pond. (giant water bug #34)
d) An insect that is a fierce fighter and takes an air bubble down with it when it dives. (predaceous diving beetle #38)
e) Some people call it a "wiggler." (mosquito wiggler #37)
f) The larva of the predaceous diving beetle. (#19)
g) The fish which is considered the best fighting fish in a pond. (bass #45)
h) A bottom feeding fish that is a scavenger and has scales. (carp #47)
i) A bottom feeding fish that is sometimes a scavenger and has no scales. (catfish #48)
j) A panfish that belongs to the sunfish family. (bluegill #46)
k) An insect that swims upside down. (backswimmer #33)
l) The pupa stage of an insect. (mosquito pupa #36)
m) Small animals with cilia. (paramecium, stentor and rotifer #s 17, 21, 32)
n) A small crustacean that is sometimes called a water flea. (Daphnia #31)
o) A drifting crustacean that is smaller than a water flea. (Cyclops #30)
p) Green algae. (desmids #28)
q) The algae that can make the water look like pea-soup. (blue-green #27)
r) A dragonfly nymph (#25)
s) The larva of the midge and an excellent food for fish. (bloodworm #14)
t) The largest of our wading birds. (great blue heron #53)
u) A wading bird that has a black crown. (black-crowned night heron #52)
v) An animal that eats dead plants. (snail #20)
w) An animal that can eat larger fish, has a bad temper and can be dangerous when captured. (snapping turtle #44)
x) A bird that feeds on the bottom of the pond. (mallard duck or pied-billed grebe #s 54, 55)
y) An animal that can attach itself to your body and suck out blood. (leech #16)

z) The adult insect that develops from the bloodworm. (midge #60)
aa) An insect that can catch its food as it flies. (dragonfly #58)
bb) A damselfly nymph. (#24)
cc) A mayfly nymph. (#26)
dd) An animal that could grow two heads. (planaria #18)

5. A packet of laminations is marked "food chain." This is the food chain illustrated on page forty-nine. It can be reconstructed on the magnetic board as it is discussed.

6. Ask the students to construct other food chains by placing the producers and consumers in proper sequence.

7. Ask the students to design their own magnetic board activities using the laminations on hand.

8. The boy in the canoe can be used as an index marker. By starting the canoe over the deep portion of the pond, the students describe the types of plants and animals one might find at various points under the canoe as the boy paddles to shore.

9. A particularly bright and interested youngster might desire to research the idea of food webs. He could then construct a food web and explain it to the class by using the magnetic board.